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ABSTRACT

The 15 lessons in this step-by-step guide for grades 4-8 are intended to promote the development of thinking skills through the use of databases. These lesson plans, which include specific instructions for using Microsoft Works, constitute a complete unit on the states of the United States. A disk containing 16 files for use with the lessons is available separately as well as a set of worksheet and transparency masters. While this unit is designed for use in grades 4-8, the scripted lessons are aimed at grades 5-6, so some adjustment may be necessary to meet the needs and abilities of other grades. It is noted that some teachers will want to use the lesson plans and masters merely as guides; others may find that the materials meet their needs exactly. It is also noted that the lessons are designed to be adaptable to any database program and any curriculum area. Appended materials include instructions for copying data file and data disks; a list of files on the data disk; a 27-item bibliography; worksheet answers; a glossary; a list of the accompanying transparencies and worksheets; and reprints of 15 related articles from "The Computing Teacher": (1) "The Database: Getting to Know You" (Larry Hannah); (2) "Teaching Database Search Strategies" (Larry Hannah); (3) "Brontosaurus Meets the Computer" (Shirley Krueger); (4) "The Database as a Resource in the Earth Science Classroom" (Janet Woerner); (5) "The Student-Designed Database" (Rick Thomas); (6) "A Focus on History" (Rick Thomas); (7) "Problem Solving with Databases" (Beverly Hunter); (8) "The Computerized Database: Not a Simple Solution" (Don Rawitsch); (9) "Learning to Like Social Studies" (Betty Collis); (10) "Databases in the English Class: A Valuable Lesson" (Ruthie Blankenbaker); (11) "The 'Why' of Instructional Computing" (Suzanne Bailey); (12) "Making Sense of World Power" (Alice Jagger, Tom Layton, and Bob Veeck); (13) "Enhancing Learning through Debriefing" (Bob Gray); (14) "Database Activities in a One-Computer Classroom" (Jim Watson); and (15) "A Mineral Database" (Jacob M. Hirschfelt). (DB)

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TEACHING THINKING SKILLS WITH DATABASES

Macintosh Microsoft® *Works* Version

BY JIM WATSON

A step-by-step guide for grades 4-8

Adaptable for use with any subject area

Complete unit of 15 scripted lessons plans on the states of the United States

16 Microsoft *Works* files on disk

62 worksheet and transparency masters

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ABOUT THE AUTHOR

Jim Watson is a computer teacher/coordinator at the elementary level in Eugene, Oregon. His academic background is in history, elementary education, guidance and counseling, and computers in education. Jim became interested in computers in 1981 when he saw them as a means of broadening the scope of what students can learn in school. In 1986, he co-authored Eugene School District's problem-solving curriculum for grades K-5. *Teaching Thinking Skills With Databases* is an outgrowth and extension of that work.

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To Amy Michelle

TABLE OF CONTENTS

INTRODUCTION

Organization 1
Grade Level 1
Microsoft *Works* 1
States of the U.S. Unit 2
Scripted Lessons 3
Copyright 3
Site License 3
Data Currency 3
Higher Order Thinking Skills 3
The Computer Database 4
Is a Computer Lab Necessary? 5
The Teacher's Role 6
Cooperative Learning 6
Sample Files 7
Other Subject Matter that Can Be Explored with Databases 7
Follow-up: What to Do After the First Database Unit 8

LESSONS

1. Introducing the Database Unit 11
2. Database Terminology and Browsing 21
3. Arranging and Exploring the Data File 33
4. Selecting Records 45
5. Planning and Printing Reports 55
6. Including More Information in Reports 61
7. Generating Questions to Answer with Printed Reports 65
8. Introduction to Hypothesis Testing 71
9. Generating and Testing Hypotheses 77
10. Data Analysis Techniques 83
11. Synthesis and Evaluation 97
12. Extensions 113
13. Building a Data File (Optional) 125
14. Creating a Data File (Optional) 137
15. Final Projects 143

APPENDIX A: Copying Data Files and Data Disks....147

APPENDIX B: Files on the STATES Data Disk....149

APPENDIX C: Bibliography....151

APPENDIX D: Answers to Worksheets....153

APPENDIX E: Glossary....157

APPENDIX D: Transparency/Worksheet List....161

APPENDIX G: Related Articles

The Database: Getting to Know You
Larry Hannah....165

Teaching Database Search Strategies
Larry Hannah....169

Brontosaurus Meets the Computer
Shirley Krueger....175

The Database as a Resource in the Earth Science Classroom
Janet Woerner....179

The Student-Designed Database
Rick Thomas....183

Problem Solving with Databases
Beverly Hunter....187

The Computerized Database: Not a Simple Solution
Don Rawitsch....193

Learning to Like Social Studies
Betty Collis....197

Databases in the English Class: A Valuable Lesson
Ruthie Blankenbaker....201

The "Why" of Instructional Computing
Suzanne Bailey....203

Making Sense of World Power
Alice Jagger, Tom Layton and Bob Veeck....207

Enhancing Learning through Debriefing
Bob Gray....211

Database Activities in a One-Computer Classroom
Jim Watson....213

A Mineral Database
Jacob M. Hirschfelt....217

A Focus on History
Rick Thomas....219

INTRODUCTION

ORGANIZATION OF THE BOOK

The body of this book consists of 15 lessons accompanied by worksheet/transparency masters. The lessons are designed to be generic—applicable to any database program and any curriculum area. Specific instructions are included for the database part of Microsoft *Works*. The 15 lesson plans are designed to illustrate how to use a unit on the states of the U.S. to implement the teaching of thinking skills with databases. Some teachers will want to use the lesson plans and masters merely as guides; others may find that the materials provided on the states of the U.S. meet their needs exactly.

The heart of the material is a step-by-step model for teaching thinking skills while introducing databases through subject matter. It is a model that can be used with any database program and with data on almost any topic. This introduction provides a rationale for using databases to teach thinking skills. It also gives suggestions for management techniques, a description of the teacher's role, and ideas for other subject-matter applications.

GRADE LEVEL

This unit is designed for use in grades 4-8. The scripted lessons are aimed at grades 5-6, so some adjustment may be necessary to meet the needs and abilities of other grades. Developmental readiness for some of the highest-order skills will vary with the age and experience of the class and individuals within the class. I've found that nearly all fourth graders are able to succeed with *analysis*-level tasks (Lesson 10, page 93) and that many are also ready for extra projects involving *synthesis* and *evaluation* (Lesson 11, page 109).

MICROSOFT *WORKS*

The Microsoft *Works* database is a relatively easy program to use, but it is not known as a "beginners database" because it has many advanced features. Since this is a unit for beginners, many Microsoft *Works* capabilities will not be used. The teacher should be somewhat familiar with the program, however, before teaching the unit. Classes on using Microsoft *Works* are commonplace through school districts, colleges, community centers, and computer stores. Some additional resources that may help include:

Works Tour—An introduction on a disk that comes packaged with Microsoft *Works*.

Microsoft Works for the Macintosh: A Workbook for Educators: (rev. ed.) by Keith Wetzel. (1989). Published by ISTE. A hands-on guide to using the database, word processor, and spreadsheet as a teacher tool as well as an instructional tool.

Using Microsoft Works—The manual that comes with the program. In this book I will occasionally refer readers to the manual (version 2.0) for more complete Microsoft *Works* instructions.

STATES OF THE U.S. UNIT

The major purpose of the States unit included in this book is to provide concrete examples of how to proceed with the various steps in the process of using databases to teach thinking skills. Complete lesson plans on the States unit immediately follow an "overview" description to clearly show how the skill can be taught. A teacher using a database to teach skills in an area other than U.S. states would use these lessons to gather teaching ideas that can be applied to the topic under study.

But the States unit can also stand alone. The 15 lessons form a solid teacher-tested unit complete with objectives, pre-teaching preparation needs, review activities, teaching procedures, worksheet and transparency masters, follow-up activities, and data on disk.

The STATES file on the disk includes a variety of information about each state:

- Region
- Year of admission
- Area
- Population
- Number of U.S. Representatives
- Population density
- Growth rate
- Acres of federal forest land
- Unemployment rate
- Urban population
- Family size
- January high temp
- January low temp
- July high temp
- July low temp
- Elevation
- Rainfall
- Manufactured product
- Agricultural product
- Mining product

As students use the States unit to develop their thinking skills, they will be able to use the kind of information listed above to analyze relationships among the states and attempt to draw conclusions to explain the relationships. Is there, for example, a relationship between a state's growth rate and its unemployment rate? Do fast growing states have more or less unemployment than slow growing states? Why? Why do people move? Is employment the only reason? What do fast growing states or fast growing regions have in common? Products? Temperatures? Population density? With 27 categories of information on each state there are thousands of other possible relationships to examine.

The *content* of this unit is interesting to me, but I do not consider it essential knowledge. I do not recommend a database unit on the states of the United States that concludes with a test on what students have learned about the 50 states. I assume they will learn plenty of facts, but because students are encouraged to pursue solutions to self-generated problems, each student will learn his or her own set of facts. In my opinion it is more important that students learn to use information (from a variety of sources, including computer databases) to solve problems and test hypotheses than it is for them to learn the facts themselves.

The questions students generate from such data are not the typical knowledge-level questions one might find at the end of the textbook chapter. In one recent class, a fifth grader browsing through the states data file thought she had found an error in the data when she saw that Texas had a lower unemployment rate than Oregon. Her uncle had just moved from Texas to Oregon because he couldn't find work in Texas. The search for an explanation opened a channel of thought that led the student to do outside research on the oil industry, her uncle's job skills, boom-bust cycles, and how unemployment figures are generated. This kind of personal involvement with information is not rare when using databases to teach thinking skills. The states of the U.S. unit has the depth of information to stimulate in-depth analysis.

SCRIPTED LESSONS

The lesson plans that follow each Overview are, to a large extent, scripted. But the script is not meant to be used verbatim; it is only to give you an idea of how you might teach the lesson. Please do not feel bound to use my words. I don't!

COPYRIGHT

Materials in this book are copyrighted and may not be copied without permission of the publisher. A site license including permission to copy worksheet and transparency masters as well as the data disk is provided with the purchase of this courseware (see below). Microsoft *Works* program disks must be purchased separately and are not to be copied except as permitted by its publisher, Microsoft Corporation.

SITE LICENSE

Permission is hereby granted to copy the following parts of *Teaching Thinking Skills with Databases* for use within the school building that has purchased the book:

- The STATES data disk
- The WORKSHEET and TRANSPARENCY MASTERS

DATA CURRENCY

Census and other data on U.S. states is constantly updated. The data in the STATES file was the most current available when the file was created. When known, dates for the data in the STATES file are noted on the MEANINGS master in Lesson 2 (page 32). Students should be made aware of the time frame for which their observations have meaning. Teachers may also wish to update, or have students update, any or all of the data as figures from the 1990 census become available.

HIGHER ORDER THINKING SKILLS

Students who leave school with just a set of static facts will be ill-prepared for a world in which they will change careers six to 10 times (Bailey, 1986). Today's students need to know how to *get* the facts and how to *use* them well. Electronic databases offer a wide range of opportunities for them to obtain such skills. The marriage of higher order thinking skills—analysis, synthesis, and evaluation (Bloom, 1956)—and computer databases is a natural! As students learn to use a database manager for storing, manipulating, and organizing information, they can generate and answer questions, as well as formulate and test hypotheses. By doing so, students will take a giant step toward preparing themselves for the information age.

The work of Benjamin Bloom (1956) provides the framework for the lessons in this book. Students will progress from *knowledge*, *comprehension*, and *application* level tasks to the higher order thinking skills of *analysis* (breaking down information to find relationships and connections), *synthesis* (pulling together and organizing the information to clarify the big picture), and *evaluation* (making personal judgments to explain the meaning and importance of findings).

This hierarchical model is open to question and a very good case can and has been made for a more holistic approach to learning thinking skills. I have chosen a hierarchical model primarily for convenience. My attempt is to link "lower level" thinking skills to "introductory" database skills as shown in the chart below.

Bloom's Taxonomy Level		**Database Skill**
Knowledge	=	Browse for information.
Comprehension	=	Rearrange or select data.
Application	=	Plan and print reports.
Analysis	=	Print reports to facilitate finding relationships in data.
Synthesis & Evaluation	=	Pull data together to explore an issue in depth and formulate and support opinions.

My links between thinking skills and database skills, as illustrated above, are somewhat arbitrary, but they provided me with a structure upon which to base the lessons in this book. My advice would be to teach higher skills (thinking or database) as the need or opportunity presents itself in your class. If, for example, there arose a problem that would be easier to solve if students knew how to select records, a skill they had not yet learned, you might very well decide that the time had come to teach the students how to select records. I also recommend that the pace of instruction be brisk enough to keep it lively and, if it is not possible to keep the class together at a brisk pace, that the format of the class become more individualized. Students should not be walked through parts of the model that they can run through.

THE COMPUTER DATABASE

A computer database is a valuable **teaching/learning** tool with the potential to help the teacher present material in more depth, in a different and interesting way. The database is essentially an electronic filing system with the ability to sort, reorganize, and search for information. While a database manager is not the tool for every teaching situation, it has several strengths: 1) it can contain an incredible amount of information; 2) it can organize data in a variety of formats; and 3) it is very fast at finding and organizing information. Once students become comfortable using databases, they will be able to use them (or even create them) for independent projects.

With these advantages, a database provides an ideal environment for students to learn organization, analysis, synthesis, and evaluation of information. Students can gather, format, and update information; show relationships; find trends; rearrange information; and test hypotheses (Hunter, 1985). In short, a database allows students to go beyond the facts . With the help of this tool, students can use higher level thinking skills to explore the *meaning* of the facts. As the students begin using the database to make connections, see relationships, and draw conclusions, you are going to hear a lot of "Aha"s in your classroom. Clearly, databases are an exciting way to learn subject matter *and* thinking skills.

IS A COMPUTER LAB NECESSARY?

Obviously databases are **hands-on** computer programs. Students need access to appropriate equipment, and having a lab is a big advantage. But a lot can be achieved without a whole lab full of computers. Can the advantages described above be realized in the one-computer classroom? From my experience the answer is "Yes!" In fact there are several advantages to introducing databases in a one-computer classroom:

1. Less instructional time is required when one computer is being used by the whole class, as it is not necessary for every student to know every command of the particular database program being used.

2. The first time a teacher uses a database with a class, the unit may be a little on the rough side. With a computer in the classroom, however, omissions and errors in instruction are discovered by the first group on the computer and can be corrected for the rest. In a lab, the difficulty correcting these errors is multiplied by the number of students assigned to computers. Picture the mayhem as one by one the groups in the lab discover that an important step has been left off an instruction sheet.

3. Use of one computer for the whole class can also foster a spirit of teamwork and cooperation. Pressure on less-able students is reduced when they do not have to produce results from a database totally on their own. In a lab, students frequently become involved in races with those at adjacent computers, with sloppy work being the result. Such competition is less likely in a one-computer classroom.

4. Having the computer in the classroom instead of the lab also gives a direct connection between the regular curriculum and the computer lesson. A trip from the classroom to the lab often makes this connection difficult to maintain. (A computer lab is closer to an arcade than a classroom for some students.) And while the lab schedule does not often tie in neatly with the flow of the curriculum, the classroom computer is always ready for the teachable moment.

In the classroom, a computer and a printer can form a single or one of several learning centers. Student groups of two or more rotate to the computer while other students are at their desks or working at other centers. This approach does require extra planning and the teacher must think about two or more activities going on at one time. But it can work if you follow the usual advice for this approach, such as designating and training some student experts and/or outside volunteers.

Whole-class activities used to introduce any computer program to a single-computer classroom are also appropriate for introducing and demonstrating database use, no matter how many computers are available for individual or group work. A large-screen monitor or, preferably, a data projection panel is necessary for whole-class demonstrations.

Clearly there is room for databases in both the lab and the classroom. But it is liberating to know that a school does not need a lot of hardware to make a database unit possible.

THE TEACHER'S ROLE

As with word processors, there are no motivational enhancements in database programs. Self-motivation comes after the students discover what can be done with them. In the beginning, the teacher will need to provide motivation in the form of strokes and reassurance that the skills being learned are of value.
The real-life connection of the unit can also be motivating. Taken by itself, a database is just a collection of facts and figures. No matter how useful the information is, no matter how carefully sorted and selected, it needs *humans* to analyze and evaluate it. It is tempting to accept the information as the cold hard facts and forget two things: 1) facts are rarely objective; and 2) there are very real people behind the facts. Unemployment figures, for example, represent thousands of people who desperately need jobs. It is up to the teacher to help the students put the facts in perspective.

The key to perspective is **debriefing**. Each analysis, each conclusion drawn from data, must be accompanied by conferences or whole group discussions that help students gain perspective on the results. The Sunburst demonstration videotape *Using Databases in the Classroom* shows how a properly timed question can steer students in productive directions. (This tape may be freely copied by schools and is a good introduction for teachers and students.) Some questions a teacher might ask during debriefing conferences include:

- What is the answer to your question?
- Does the report seem to support your hypothesis?
- Can you point out some data in your report that seems to support the hypothesis?
- Can you point out some data that seems to refute the hypothesis?
- Could you make a new hypothesis based on the data?
- Even though data seems to support a conclusion, does it *prove* it? What would it take to prove it?
- Does the conclusion make sense? Can you explain it?
- What is your opinion about this topic now that you've examined it?
- Who might be interested in the results of your report? Could the results help anyone?
- What was your strategy for using the database to answer your question?
- Is any of the data suspect? How do you think it was gathered? Where could mistakes have been made?
- Can you learn anything from data that shows no relationship between certain categories?
- Do your results raise more questions? How could they be answered? Are any of these questions important and interesting enough to examine in a project?

COOPERATIVE LEARNING

The best creative thinking is often done in collaboration with peers. This unit offers an opportunity to allow children to work together toward a common goal. In computer work, two is the best number for a cooperative learning group, although sometimes two partnerships can be combined to form a group of four. With two students in a group, computer access is easier and it is less likely that one student will be left out. Students should be *assigned* partners rather than being allowed to choose their own. Heterogeneous groups work well in computer work. Mixed sex, race, and ability groups can be formed, when appropriate, and social isolates can be paired with those who can model good social skills. Students with different learning styles often make good teams. Partnerships can be left in place throughout the unit or they can be changed at some pre-designated mid-point.

SAMPLE FILES

A very useful feature of this courseware is a series of *sample files* (listed below) on transparency masters that follow Lessons 3, 4, 5, 7, 8, 9, 10, and 13. These files are also on the accompanying data disk. They are designed to guide the teacher in reviewing previous concepts while at the same time showing students a variety of uses for databases. The lessons in the States unit frequently begin with discussion of one or more of these sample file transparencies.

- AL BAT CHAMPS
- ANIMALS
- DRIVERS
- EARLY SPACE FLT
- GAMES
- LIFE EXPECTANCY
- LITERACY
- MOUNTAINS
- MOVIE MONEY
- OCEANS AND SEAS
- PHONE BOOK
- REJECTIONS
- RESEARCH FILE (blank records)
- STATES

In addition, four other files are included on the disk. These files can be used to extend the ideas in the lessons:

1. ETHNIC AMERICANS *(blank records)*
2. NATIVES—*A data file on current American Indian tribes.*
3. PLANETS
4. WHO ARE YOU? *(blank records)—A "getting-to-know-each-other" data file.*

OTHER SUBJECT MATTER THAT CAN BE EXPLORED WITH DATABASES

Databases can be used to teach material from almost any subject area. Examples include:

- Social Studies: states, countries, elections, oceans, cities, rivers, mountains, current events, presidents, women, pioneers, explorers, immigration
- Science: elements, animals in general, any particular type of animal, dinosaurs, inventions, planets, constellations
- Health: foods, drugs
- Language Arts: favorite books, authors, vocabulary, parts of speech, spelling words,
- Multicultural Education: notable people from various ethnic groups, Native American tribes
- Art: artists, styles, periods, media
- Miscellaneous: Summer jobs, baseball, community activites

Reprints of some articles on databases that have appeared in *The Computing Teacher* are included in the Appendix. Those looking for more examples or for lesson plans on many of the above topics are advised to look at issues of *The Computing Teacher* (published by ISTE). In addition, nearly every issue of *Teaching and Computers* (published by Scholastic) has a practical database activity that can be adapted to build thinking skills.

FOLLOW-UP: WHAT TO DO AFTER THE FIRST DATABASE UNIT

Below are some of the activities a teacher might consider to help students solidify the skills they have learned after one unit.

1. Have a final, congratulatory party. Be sure students realize how much they've learned, how far they've come, how much **real** thinking they have done.

2. Ask the students to evaluate the unit. What did they like best about the unit? What could make it better for other groups?

3. Before you forget, note any changes you will want to make when you teach the unit to a different class.

4. Do another database unit on another topic with the class. You will be amazed how fast and painless it will be now that the students are skillful using the database. They will get the same benefit (or even more) with a lot less time and effort.

5. Save materials produced by this class, especially if they have created a data file of their own. Such a data file represents a great deal of time and effort and can serve as a valuable resource. The students can take pride in the fact that their creation may serve as an information source for the classes that follow them. The files of several year's classes could be used to compare changes in the data over time.

6. Share your ideas and contributions with your fellow teachers and with us. Write me or ISTE to let us know how databases have worked with your classes, what worked, what didn't, your suggestions, topics you used, and so forth. We would truly value your experiences and opinions.

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TEACHING THINKING SKILLS WITH DATABASES

LESSONS

OVERVIEW OF LESSON 1 Introducing the Database Unit

Bloom Level 1—Knowledge
The first lesson of the database unit should motivate students—get them excited about the unit. Start by listing some of the things they will learn to do:

- Rearrange lists with the stroke of a key.
- Get the computer to find information for them.
- Learn to use a database to find answers to questions.
- Design and print reports.
- Analyze data.
- Find relationships between data.
- The project in Step 15 (page 153).

Some of the ways to introduce students to databases are listed below. Any of these can give the students an introductory idea of what databases are all about.

1. Demonstrate the speed of computer data handling by racing the computer against the class in rearranging data. See the lesson on the following pages for an example with the States unit.

2. Show the class a very large data file to illustrate how much data a file can include.

3. Give the class a glimpse of the data files on the included Teaching Thinking Skills Data Disk in the pocket of this notebook. Show students the variety of types of information that can be stored in a data file.

4. Build a personal data file of students in your class that includes students' hair color, address, favorite food, favorite song, etc. See Hannah (1987, included in Appendix G) for detailed instructions. It is a real motivator to have students themselves be the data in their first data file. Demonstrate the usefulness of databases by arranging and searching this personal information.

5. Model a data file you personally use to make a task easier (a gradebook or mailing label program, for example).

6. Invite a guest expert to explain and demonstrate how a database can be used. Prospects might include the principal, secretary, librarian, a parent, or a local business person.

7. Show a film, video, filmstrip, or demonstration disk designed to introduce databases to students at your grade level.

LESSON 1 Introduction to the States Data File—Arranging

OBJECTIVE

Students will compare the process of arranging information by hand and by computer.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration.

MATERIALS REQUIRED

1. One set of STATE POPULATION CARDS (pages 16-20) for each pair of students.
2. Scissors for each student.
3. Political map of the U.S. on the wall.
4. Stopwatch or clock with sweep hand.

PREPARATION BEFORE CLASS

1. Introduce yourself to the Microsoft *Works* Database. See Introduction, for references.
2. Open the STATES file on the States data disk. (See *Using Microsoft Works* pp. 4-5.)
3. Browse through the STATES database file to become familiar with it.

PRESENTATION

Note: To avoid expectations to the contrary, tell students they will not have hands-on computer time in this lesson.

1. *Introductory activity*: Discuss these questions: What state do you think has the highest population? The lowest? The second highest? and so forth. Accept all answers.
2. *Instruction*: "Today we are going to find out the answers to these questions by putting the states in order by population."
3. Pass out one set (5 pages) of STATE POPULATION CARDS to each pair of students. Discuss the information on the cards. (Population is listed in millions of people.)
4. Ask the students to cut the cards apart and put them in order by population from largest to smallest (largest populations on top).
5. When they are finished, briefly discuss the relative populations of the states. You may want to have a volunteer point out the states on the map as you discuss them. (See Appendix D, page 162, for proper order.)

6. "Next, I'm going to time you to see how quickly you can do a different arrangement. I will be timing you to see how fast you are. When I say, 'Go,' put your cards in alphabetical order by state name." Answer any questions. When you tell them to start, begin timing. Stop timing when the first group is done. (See Appendix D, page 162, for proper order.)

7. When all groups are finished, discuss the techniques they used to alphabetize the cards and check the accuracy of their arrangements by having one group read the names of the states in order. "Was it a fun activity? Boring? Easy/hard? Can you name some adult jobs that are mostly putting things in order?" (A file clerk would be one example.) "Would any of you like to do that for a living?" Collect the cards.

8. Move to the computer. "One of the jobs a computer can do very well is the job you just finished: arranging. We will take a look at how a computer does it. This computer has a database program loaded into it. A database is an *organized collection of information*. In the next few days we will be studying about databases and you will have chance to learn lots more about them. The database program we will be using is called Microsoft *Works*."

9. "Stored in the database in this computer is a collection of information called a **data file**. The stack of cards you sorted is also a data file. The data file in this computer is named STATES, and it has information on the states of the U.S. stored in it, including the information on the cards you just arranged. We will use the data file to do the same arrangements you just did. First let's watch the computer arrange the STATES file by population like you did with the cards."

10. Use the following instructions to demonstrate arranging the data file by population (See *Using Microsoft Works* p. 161-163). Tell the students what keys you are pressing as you follow the instructions.

    a. Select **Show Form** from the Format Menu (or press Command-L) to zoom in on one record. (To use the mouse, click and hold on the "Format" menu move the mouse down until "Show Form" is highlighted, then release the mouse button. To use the keyboard, hold down the the "Command" key—the one to the left of the space bar with a cloverleaf shape on it—and tap "L.")

    b. Use the Down Arrow key or mouse click to highlight the POPULATION field.

    c. Select Sort from the Organize Menu (or press Command-A) to arrange.

    d. Click to select From 9 to 0 (largest to smallest). Press RETURN.

    e. Hold down or tap the Down Arrow key (or TAB) to scan the file. Point to the POPULATION field to demonstrate that the records are in order.

11. "Now we will use the stopwatch to time an alphabetical arrangement of the data file. The computer will race against the time of the fastest of our groups."

12. Use the following instructions to demonstrate arranging the data file *alphabetically* :

    a. Use the Arrow keys or a mouse click to highlight the STATE field.

    b. Select Sort from the Organize Menu (or press Command-A) to arrange.

    c. Prepare to use a stopwatch or a sweep hand to see how long it takes to arrange the records alphabetically.

   d. Simultaneously begin timing as you press RETURN (or click OK) to accept From A to Z.
   e. Stop timing when the "sort window" disappears from the screen. You'll have to be quick because this happens in about 1 second).
   f. Hold down or tap the Down Arrow key (or TAB) to scan the file.

13. Calculate the time difference between the computer's arranging process and the population card arrangement the students did. Discuss the differences in time, accuracy, and effort of the human process versus the computer process.

14. Point out (or have the students figure out) that to do a computer arrangement you must:

   a. Have a computer.
   b. Have a database program.
   c. Have data entered into the program.
   d. Know how to use the database.

15. "Each year there are more computers with databases and files that are made available to us in libraries, homes, businesses, shopping, and entertainment. Knowing how to use them will be a big advantage to us."

16. "You will learn to do many things with databases in this unit. In the next few lessons, we are going to learn to use the Microsoft *Works* database. In this unit we will be studying the states of the U.S., but once you see what you can do, you'll find many other uses for databases."

State Population Cards

Alabama **4.0**	**Alaska** **0.5**
Colorado **3.2**	**Connecticut** **3.2**
Hawaii **1.0**	**Idaho** **1.0**
Kansas **2.4**	**Kentucky** **3.7**
Massachusetts **5.8**	**Michigan** **9.1**

State Population Cards

Arizona **3.1**	**Arkansas** **2.4**
Delaware **0.6**	**Florida** **11.0**
Illinois **11.5**	**Indiana** **5.5**
Louisiana **4.5**	**Maine** **1.2**
Minnesota **4.2**	**Mississippi** **2.6**

State Population Cards

California **25.6**	**New Jersey** **7.5**
Georgia **5.8**	**Ohio** **10.8**
Iowa **2.9**	**South Carolina** **3.3**
Maryland **4.3**	**Vermont** **0.5**
Missouri **5.0**	**Wyoming** **0.5**

State Population Cards

Montana **0.8**	**Nebraska** **1.6**
New Mexico **1.4**	**New York** **17.7**
Oklahoma **3.3**	**Oregon** **2.7**
South Dakota **0.7**	**Tennessee** **4.7**
Virginia **5.6**	**Washington** **4.3**

Worksheet/Transparency for Lesson 1

State Population Cards

Neveda 3.1	New Hampshire 2.4
North Carolina 0.6	North Dakota 11.0
Pennsylvania 11.5	Rhode Island 5.5
Texas 4.5	Utah 1.2
West Virginia 4.2	Wisconsin 2.6

OVERVIEW OF LESSON 2 Introduction to Database Technology

Bloom Level 1—Knowledge
Comparing a database to a traditional filing cabinet can help students understand the purpose of databases while at the same time introducing them to database terminology. The States unit lesson on the next page uses a "dummy" file to draw the analogy as follows:

Database = File cabinet
Data File = File folder
Record = One page of the file folder
Field = A single item on each record
Entry = The information in a field

Use a real computer data file to reinforce the terms after they have been taught. Browsing slowly through the file (displayed on a large screen monitor or LCD overhead viewer), stop from time to time to quiz students on terms. Ask questions like:

- What is the name of this file?
- Who can name a field on this record?
- What is the entry in that field?
- Is this word a field or an entry?

Invite students to stop you as you browse for discussion of information that interests them.

LESSON 2 Database Terminology—The File Cabinet Analogy

OBJECTIVES

Students will:

a. learn how a database and a file cabinet are alike, and
b. browse through an already-created data file on U.S. States, raising questions and defining terms as they go.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration.

MATERIALS REQUIRED

1. Overhead projector.
2. Transparencies of COLORADO (page 30) and MEANINGS (page 32).
3. A PAPER STATES FILE. [Prepare by labeling a file folder STATES and inserting duplicated paper copies of the records for ALABAMA, ALASKA, ARIZONA, ARKANSAS, CALIFORNIA, and CONNECTICUT (pages 25-31), and placing COLORADO transparency between California and Connecticut.]
4. An ordinary FILE CABINET with the STATES FILE planted inside.
5. Butcher paper or a chalkboard (preferably dust-free).

PREPARATION BEFORE CLASS

1. Pre-load Microsoft *Works* and the STATES file into the computer. Select **Show Form** from the Format Menu (or press Command-L) to view the first record. You may want to turn off the monitor until computer is needed.

PRESENTATION

Note: To avoid expectations to the contrary, tell students that there will be no hands-on computer time in this lesson. Assure students that they will be using the computer in the next lesson.

1. *Introductory activity*: Review—"Can you give me a definition of a database?" (*An organized collection of information*). "Do you think a database has to be in a computer?" (No).

   Point to the file cabinet. "In fact, this file cabinet is a database—an organized collection of information."

2. Open your file cabinet and pull out the STATES file. "Inside the database is a lot of information in folders. Each file folder contains one data file. A file is a set of information about one topic."

3. "This particular file, for example, is about the states of the U.S." Write "EXAMPLE OF FILE = STATES" on chalkboard or butcher paper.

4. "A file is a collection of information about one topic, like states of the U.S., countries of the world, names and addresses, overdue books, and so forth. Can you name some other possibilities for database files?" (Sports statistics, inventories, school grades, etc.).

5. Open the folder and show students the papers inside. "Inside this file titled 'STATES' we have some papers, and each one has the name of a state on it—Alabama, Alaska, Arizona, Arkansas, California, Colorado, and Connecticut. These pages are called records." In this file, each record is about one state. Write "EXAMPLE Of RECORD = COLORADO" on the chalkboard or butcher paper. In a library data file, each record would be about one book. What would each record be about in a name and address file?" (A person's name). "What would each record be about in a baseball statistics file?" (Each player or each team).

6. Put the COLORADO RECORD transparency on the overhead. Point to the word STATE on the record, then run your finger down the field names on the transparency. "Each piece of information on a form is called a field. Name some of the fields in the STATES data file." Tell students that every record has exactly the same fields. (Area, region, population, etc.). Write "EXAMPLE OF FIELD = AREA" on the chalkboard.

7. The information in each field is called an entry. Explain that the field names are the same on each record in the data file but the entries in the categories may be different. For example, the record on Connecticut would have a field entitled AREA just like the one on Colorado, but the entry would be a smaller number—because Connecticut has less area.

8. Place the transparency of MEANINGS on the overhead projector. Discuss each field. Tell students that copies of MEANINGS will be available throughout the remainder of the unit.

9. "Our file is about STATES, this record is about COLORADO, and this field is called AREA. What is the entry in the AREA field?" Explain that 104 means 104,000 square miles in this data file. Write EXAMPLE OF ENTRY = 104. Have students name the entries in other categories.

10. Move to the computer. Turn on the monitor if it is off. "Let's look at the records in the STATES file on the computer." If multiple records are on the screen, select **Show Form** from the Format Menu (or press Command-L) to change to single record layout. To move through the records, click on the arrow at the bottom of the scroll bar. Pause on each record for a few seconds. Discuss students' questions and interesting entries and review terminology as you browse.

11. When you reach the last record, invite students to give their impressions of the data file. "In our next lesson we will learn some of the ways a database can be useful. You will be using the computers most of the time."

ALABAMA RECORD

State:	**ALABAMA**
PO Abbreviation:	**AL**
Region:	**SOUTH**
Admitted:	**1819**
Area:	**52**
Population:	**4.0**
US Representatives:	**7**
Pop Density:	**79**
Pop Change %:	**14**
Forest Acres:	**21.4**
Income:	**10.0**
Unemployment %:	**11.1**
Urban Pop %:	**60**
Minority Pop %:	**26**

(Source: *World Almanac and Book of Facts*, 1987)

ALASKA RECORD

State:	**ALASKA**
PO Abbreviation:	**AK**
Region:	**WEST**
Admitted:	**1959**
Area:	**586**
Population:	**.5**
US Representatives:	**1**
Pop Density:	**1**
Pop Change %:	**39**
Forest Acres:	**119.1**
Income:	**17.2**
Unemployment %:	**10**
Urban Pop %:	**64**
Minority Pop %:	**?**

(Source: *World Almanac and Book of Facts*, 1987)

ARIZONA RECORD

State:	**ARIZONA**
PO Abbreviation:	**AZ**
Region:	**SW**
Admitted:	**1912**
Area:	**114**
Population:	**3.1**
US Representatives:	**5**
Pop Density:	**27**
Pop Change %:	**42**
Forest Acres:	**18.5**
Income:	**11.6**
Unemployment %:	**5**
Urban Pop %:	**84**
Minority Pop %:	**18**

(Source: *World Almanac and Book of Facts*, 1987)

ARKANSAS RECORD

State:	ARKANSAS
PO Abbreviation:	AR
Region:	SOUTH
Admitted:	1836
Area:	53
Population:	2.4
US Representatives:	4
Pop Density:	45
Pop Change %:	18
Forest Acres:	18.3
Income:	9.7
Unemployment %:	8.9
Urban Pop %:	52
Minority Pop %:	34

(Source: *World Almanac and Book of Facts*, 1987)

CALIFORNIA RECORD

State:	CALIFORNIA
PO Abbreviation:	CA
Region:	WEST
Admitted:	1850
Area:	159
Population:	25.6
US Representatives:	45
Pop Density:	164
Pop Change %:	22
Forest Acres:	40.2
Income:	14.3
Unemployment %:	7.8
Urban Pop %:	91
Minority Pop %:	24

(Source: *World Almanac and Book of Facts*, 1987)

COLORADO RECORD

State:	COLORADO
PO Abbreviation:	CO
Region:	ROCKIES
Admitted:	1876
Area:	104
Population:	3.2
US Representatives:	6
Pop Density:	31
Pop Change %:	30
Forest Acres:	22.3
Income:	13.7
Unemployment %:	5.6
Urban Pop %:	81
Minority Pop %:	11

(Source: *World Almanac and Book of Facts*, 1987)

CONNECTICUT RECORD

State:	**CONNECTICUT**
PO Abbreviation:	**CT**
Region:	**NEW ENGLAND**
Admitted:	**1788**
Area:	**5**
Population:	**3.2**
US Representatives:	**6**
Pop Density:	**649**
Pop Change %:	**4**
Forest Acres:	**1.9**
Income:	**16.4**
Unemployment %:	**4.6**
Urban Pop %:	**79**
Minority Pop %:	**10**

(Source: *World Almanac and Book of Facts*, 1987)

MEANINGS

Region	S = South MA = Mid-Atlantic NE = Northeast MW = Midwest SW = Southwest R = Rockies W = West
Admitted	Statehood year. Year of admission to the United States.
Area	Area in thousands of square miles, rounded off to the nearest thousand.
Pop	1985 population in millions, rounded to the nearest tenth.
US Reps	The state's number of U.S. Representatives for 1987-88.
Density	Average number of people per square mile as of 1985.
Pop Change %	Percent of population growth 1970-1980.
Forest Acres	Acres of U.S.-owned forest land in millions, rounded off to the nearest tenth.
Income	Average income per person in thousands of dollars, rounded off to the nearest thousand. 1986 statistics.
Unemp	Percentage of the population that was unemployed in 1984.
Urban Pop	Percentage of the population living in cities in 1984.
Minority Pop	Percentage of the population that was Black, Hispanic, or Native American in 1984.
Family Size	Average number of people in each household in the state. 1987 statistics.
Products	The most important manufactured, agricultural, and mining products are listed.
Largest City	All of the following information is about the largest city of the state. 1987 statistics.
Pop	Population of the largest city of the state in thousands, rounded off to the nearest thousand.
Temps	Average January and July high and low temperatures in the state's largest city. (In Fahrenheit degrees.)
Elev	Number of feet above sea level of the largest city.
Rain	Average annual inches of rainfall in the largest city.

OVERVIEW OF LESSON 3 Arranging and Exploring a Data File

Bloom Levels 1-2—Knowledge and Comprehension

Students will be more than ready by now to get their fingers on the keyboards. In this step, students will learn to rearrange the data file to make it easier for them to find the answers to a series of questions like those on the EXPLORE worksheet (page 43). Then they will practice that skill at the computer.

Before they go to the computer(s), however, a little instruction is required:

1. Show the students how to change from "single record layout" to "multiple record layout" and back by selecting **Show Form** or **Show List** from the Format Menu (or pressing Command-L). (See *Using Microsoft Works*, p. 137).

2. Demonstrate cursor movement using the mouse and the Arrow, Tab, Page Up, and Page Down keys.

3. One way to illustrate the usefulness of rearranging information is to use the AREA REPORT—BEFORE ARRANGING (page 41) and AREA REPORT—AFTER ARRANGING (page 42) transparencies.

4. Teach the steps to rearranging a file: (See *Using Microsoft Works*, pp. 161-163).

   - Put the cursor on the field to be arranged.
   - Select **Sort** from the Edit Menu (or press Command-A).
   - Decide how you want the file arranged:

     a. A to Z is alphabetical order.
     b. Z to A is reverse alphabetical order.
     c. 0 to 9 is numerical order from the smallest number to the largest.
     d. 9 to 0 is numerical order from the largest number to the smallest.

   - Highlight the kind of order you choose. Press RETURN.

5. Discuss the result and process of arranging.

6. Be sure students understand what the entries in each field mean. (Use the MEANINGS transparency on page 32, Lesson 2 of the STATES unit, if you are studying the states of the U.S.)

7. Use the data file under study and a large screen display to demonstrate answering one or two of the questions on the EXPLORE worksheet (page 43) from the STATES unit or a similar worksheet.

8. Assign students to the computer(s) to find the answers to the questions on the worksheet.

9. Debrief when the assignment is complete.

10. You may also want to explain or demonstrate how a computer sorts data. Lesson 3b of the STATES unit uses a cardboard box and strips of paper to show one of the ways computers sort data.

LESSON 3a — Exploring the Data File—Arranging

OBJECTIVES

Students will learn how to use the data file to answer questions. They will be given an opportunity for hands-on exploration of the data file with a partner.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration and one or more for student use.

MATERIALS REQUIRED

1. Overhead projector.
2. Transparencies of:
   - PARTS OF A DATABASE (page 38)
   - GAMES SAMPLE FILE 1 (page 39)
   - GAMES SAMPLE FILE 2 (page 40)
   - AREA REPORT—BEFORE ARRANGING (page 41)
   - AREA REPORT—AFTER ARRANGING (page 42)
   - EXPLORE (page 43)
3. Political map of the U.S. for occasional reference.
4. EXPLORE worksheet (page 43), one for each partnership.
5. MEANINGS reference sheet (page 32 in Lesson 2), one for each partnership plus extras to be placed in a prominent location for use by students throughout the unit.
6. Make enough copies of the STATES data disk for each computer your class will be using. See Appendix A (page 157) for instructions on making copies of data disks.

PREPARATION BEFORE CLASS

1. Put one copy of Microsoft *Works* (unless it's already available on a hard disk or network) and one copy of the STATES data disk at each computer the students will be using. (See Appendix A, page 157, for instructions on making copies of data disks.)
2. Train two or three students as Microsoft *Works* "experts."
3. Decide how long each partnership will be allowed to use the computer to fill out their worksheets (15-20 minutes suggested).
4. Give students guidelines for safe and responsible use of computers and software.

5. Make partner assignments.

6. Establish a schedule for student use of computers.

PRESENTATION

1. *Introductory activity*: Review the terms *file*, *record*, *field* and *entry* using the PARTS OF A DATABASE and GAMES SAMPLE FILE 1 and GAMES SAMPLE FILE 2 transparencies. Explain that this is a "list-type" report with fields across the top instead of down the side. (In this case, the entire file is on the report.) Some questions for discussion of the sample records:

   - "What do you think this data file is called?"
   - "What does each record in the file represent?"
   - "What entry is in the____field?"

   The GAMES transparencies show a file arranged in the following four ways. Discuss how each of these arrangements might be useful.

   - Alphabetically by name. (To find a certain game by name.)
   - Alphabetically by type of game. (To locate a certain type of game.)
   - Numerically by maximum number of players. (To see the choices of games for the number of players you have.)
   - Alphabetically by difficulty. (To find a game to match the skills of the players in your group.)

2. *Instruction*. "Now let's review how to arrange with Microsoft *Works* and the States of the U.S. data file."

3. Demonstrate how to load by inserting Microsoft *Works*. Explain disk handling and proper computer/hard disk/network use at this time. Add the STATES file to the desktop.

4. Teach students how to browse with the data file.

   a. Demonstrate how selecting **Show List** or **Show Form** from the Edit Menu (or pressing Command-L) allows switching from "single record layout" to "multiple record layout."

   b. Discuss how, by having more than one record on the screen, "multiple record layout" is useful in comparing data about two or more records.

   c. Discuss how "single record layout" lets the user see *all* the information about one record at one time. Some of this information might be off the screen in multiple record layout.

   d. Show how to move the cursor from field to field with the mouse or the Arrow, Tab, Page Up, or Page Down keys.

5. Show students AREA REPORT—BEFORE ARRANGING and give them five seconds to tell you the *fifth largest state*. Then show them AREA REPORT—AFTER ARRANGING and, again give students five seconds to tell you the fifth largest state. Discuss the value of being able to rearrange data.

6. Teach students how to arrange the data file. Remind them that they saw you do this in the first lesson. Demonstrate arranging a field that the students choose:

   a. Put the cursor on the field you want to arrange.

   b. Select **Sort** from the Organize Menu (or press Command-A).

   c. Decide how you want the file arranged:

      - **A to Z** is alphabetical order.
      - **Z to A** is reverse alphabetical order.
      - **0 to 9** is numerical order from the smallest number to the largest.
      - **9 to 0** is numerical order from the largest number to the smallest.

   d. Highlight the kind of order you chose. Press RETURN.

   e. Discuss the result and the process of arranging data.

7. Demonstrate arranging another field that students choose.

8. Place transparency of EXPLORE on the overhead.

9. "What field should we arrange to answer the first question on the EXPLORE?" *(State.)* "Would we arrange it A to Z? Z to A? 0 to 9? 9 to 0?" *(A to Z or Z to A.)*

10. Find the answer *(8)* and write it on the transparency.

11. If necessary answer more questions as a group. HINT: It helps if each question is considered in two parts (deciding the field first, then deciding how to arrange it).

12. Distribute the MEANINGS sheet to partnerships and discuss how it should be used each time they look at a field that contains data they don't understand.

13. *Computer assignment*: "You and you partner will be given a certain amount of time (about 20 minutes) to explore the data file and see how many of the questions on your worksheet you can answer."

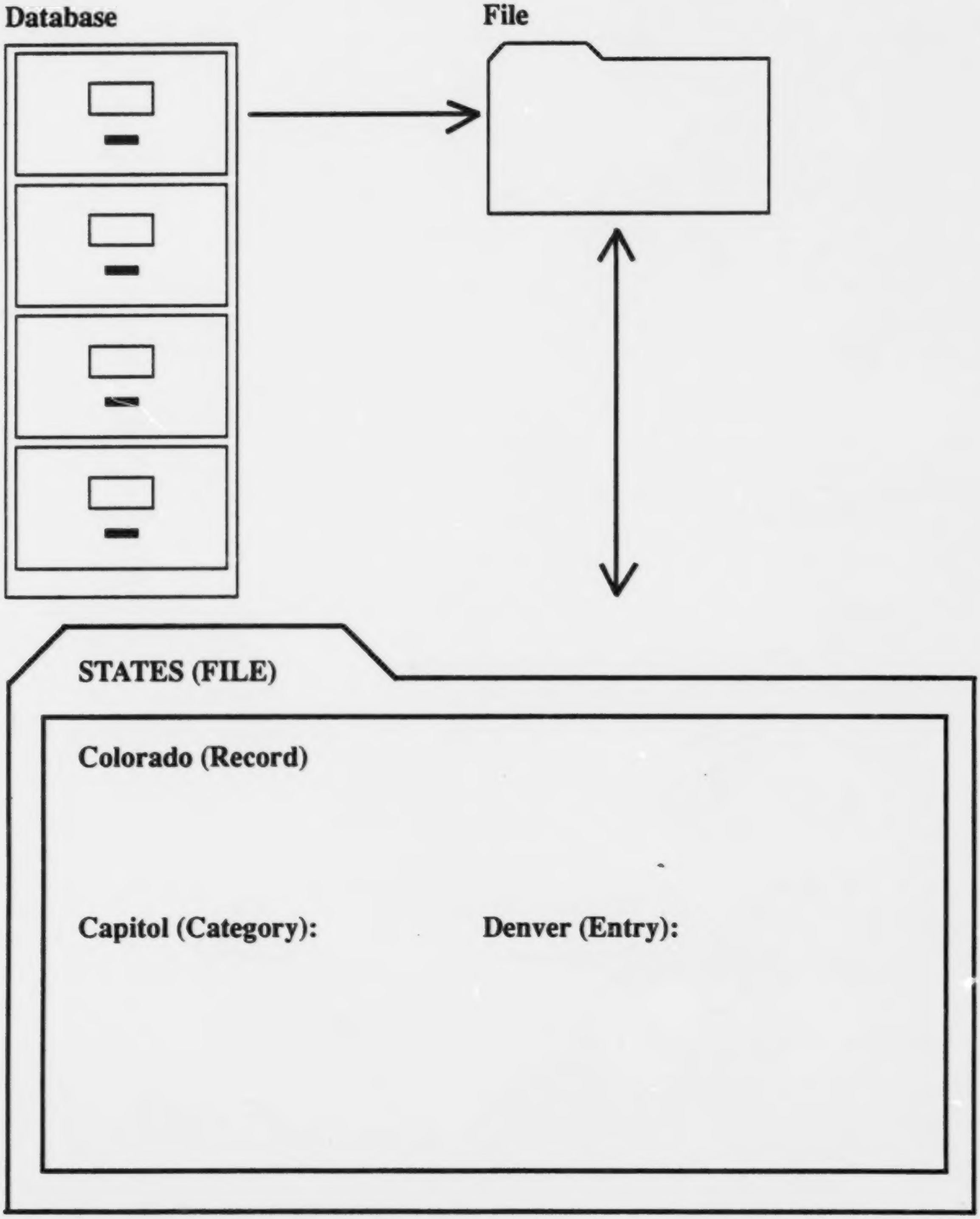
14. Introduce the student "experts" you have trained and explain their job.

15. Encourage students, when they are finished, to experiment, find things the database can't do, try to stump their partners.

16. Assign partners, distribute worksheets, and schedule computer(s). Circulate to help and motivate individuals.

17. *Follow-up activity*: Correct the EXPLORE worksheet (See Appendix D, page 161, for answers) and discuss strategies for each problem. Discuss student discoveries about the database and the data.

PARTS OF A DATABASE


Database
File
STATES (FILE)
Colorado (Record)
Capitol (Category):
Denver (Entry):

GAMES

Sample File 1

Game	*Type*	*Players Min.*	*Players Max.*	*Difficulty*
Backgammon	Board	2	4	Medium
Checkers	Board	2	2	Easy
Chess	Board	2	2	Hard
Crazy Eights	Card	2	6	Easy
Cribbage	Card	2	4	Medium
Dominoes	Tile	2	6	Easy
Hearts	Card	3	6	Medium
Mah-jongg	Tile	2	4	Hard
Monopoly	Board	2	8	Medium
Scrabble	Board	2	6	Medium
Uno	Card	2	6	Easy
Yahtzee	Dice	2	6	Medium

Game	*Type*	*Players Min.*	*Players Max.*	*Difficulty*
Backgammon	Board	2	4	Medium
Checkers	Board	2	2	Easy
Chess	Board	2	2	Hard
Monopoly	Board	2	8	Medium
Scrabble	Board	2	6	Medium
Crazy Eights	Card	2	6	Easy
Cribbage	Card	2	4	Medium
Hearts	Card	3	6	Medium
Uno	Card	2	6	Easy
Yahtzee	Dice	2	6	Medium
Dominoes	Tile	2	6	Easy
Mah-jongg	Tile	2	4	Hard

GAMES Sample File 2

Game	*Type*	*Players Min.*	*Players Max.*	*Difficulty*
Checkers	Board	2	2	Easy
Chess	Board	2	2	Hard
Backgammon	Board	2	4	Medium
Cribbage	Card	2	4	Medium
Mah-jongg	Tile	2	4	Hard
Scrabble	Board	2	6	Medium
Crazy Eights	Card	2	6	Easy
Hearts	Card	3	6	Medium
Uno	Card	2	6	Easy
Yahtzee	Dice	2	6	Medium
Dominoes	Tile	2	6	Easy
Monopoly	Board	2	8	Medium

Game	*Type*	*Players Min.*	*Players Max.*	*Difficulty*
Checkers	Board	2	2	Easy
Crazy Eights	Card	2	6	Easy
Uno	Card	2	6	Easy
Dominoes	Tile	2	6	Easy
Chess	Board	2	2	Hard
Mah-jongg	Tile	2	4	Hard
Backgammon	Board	2	4	Medium
Cribbage	Card	2	4	Medium
Scrabble	Board	2	6	Medium
Hearts	Card	3	6	Medium
Yahtzee	Dice	2	6	Medium
Monopoly	Board	2	8	Medium

AREA REPORT

Before Arranging

State	Area
ALABAMA	52
ALASKA	586
ARIZONA	114
ARKANSAS	53
CALIFORNIA	159
COLORADO	104
CONNECTICUT	5
DELAWARE	2
FLORIDA	59
GEORGIA	59
HAWAII	6
IDAHO	84
ILLINOIS	56
INDIANA	36
IOWA	56
KANSAS	82
KENTUCKY	40
LOUISIANA	49
MAINE	33
MARYLAND	11
MASSACHUSETTS	8
MICHIGAN	58
MINNESOTA	84
MISSISSIPPI	48
MISSOURI	70
MONTANA	147
NEBRASKA	77
NEVADA	111
NEW HAMPSHIRE	9
NEW JERSEY	8
NEW MEXICO	122
NEW YORK	50
NORTH CAROLINA	53
NORTH DAKOTA	71
OHIO	41
OKLAHOMA	70
OREGON	97
PENNSYLVANIA	45
RHODE ISLAND	1
SOUTH CAROLINA	31
SOUTH DAKOTA	77
TENNESSEE	42
TEXAS	267
UTAH	85
VERMONT	10
VIRGINIA	41
WASHINGTON	68
WEST VIRGINIA	24
WISCONSIN	56
WYOMING	98

AREA REPORT

After Arranging

State	Area
ALASKA	586
TEXAS	267
CALIFORNIA	159
MONTANA	147
NEW MEXICO	122
ARIZONA	114
NEVADA	111
COLORADO	104
WYOMING	98
OREGON	97
UTAH	85
IDAHO	84
MINNESOTA	84
KANSAS	82
NEBRASKA	77
SOUTH DAKOTA	77
NORTH DAKOTA	71
MISSOURI	70
OKLAHOMA	70
WASHINGTON	68
FLORIDA	59
GEORGIA	59
MICHIGAN	58
ILLINOIS	56
IOWA	56
WISCONSIN	56
ARKANSAS	53
NORTH CAROLINA	53
ALABAMA	52
NEW YORK	50
LOUISIANA	49
MISSISSIPPI	48
PENNSYLVANIA	45
TENNESSEE	42
OHIO	41
VIRGINIA	41
KENTUCKY	40
INDIANA	36
MAINE	33
SOUTH CAROLINA	31
WEST VIRGINIA	24
MARYLAND	11
VERMONT	10
NEW HAMPSHIRE	9
MASSACHUSETTS	8
NEW JERSEY	8
HAWAII	6
CONNECTICUT	5
DELAWARE	2
RHODE ISLAND	1

EXPLORE

Name(s) ____

Use the STATES data file to answer the following questions. It may help to begin by identifying the field to arrange and the type of arrangement you want.

1. How many states begin with the letter "M"? ____________________

2. What state's population grew the fastest? (Name the state.) ____________________

3. Name the state that had a falling population. ____________________

4. What is the area of the largest state of the U.S? ____________________

   What is this state's population? ____________________

5. How many states are larger in area than Oregon? ____________________

6. Name two states that are larger in area than Oregon. ____________________

7. What is the capital of North Dakota? ____________________

8. What city has the largest population in the U.S.? ____________________

9. What state has the smallest "Largest City"? ____________________

10. What state's largest city gets the most rain? ____________________

11. What state's largest city gets the least rain? ____________________

12. What state was admitted to the U.S. the same year as Florida? ____________________

13. Write your own question and answer: ____________________

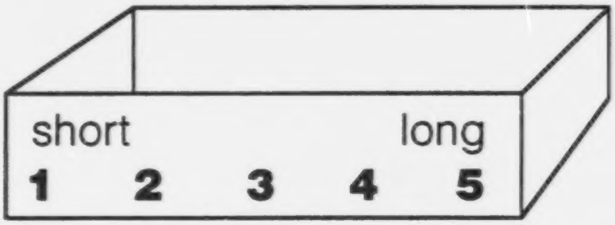
LESSON 3b Optional Lesson on Arranging

OBJECTIVE

Students will gain an understanding of how a computer arranges items.

COMPUTER(S) NEEDED FOR LESSON

None.



MATERIALS REQUIRED

1. Obtain a box (an empty duplicating paper box works well) and number the bottom 1, 2, 3, 4, 5. Label the "1" end SHORT and the "5" end LONG.
2. Cut five strips of colored tagboard of different lengths (4", 5.5", 7", 8.5", 10" or thereabouts).

PRESENTATION

Idea used with permission of Allan Dunn, Oregon City School District.

1. "We have seen that a computer can put items in order pretty quickly. Today we are going to arrange five strips of paper by their lengths and we'll use the method some computer programs use."
2. One student is chosen to be the arranger. The arranger stands behind a table in front of the class. The box is on its side on the table with the numbers on the bottom facing the class.
3. The arranger randomly places the strips of paper in the box under the numbers (class members should not be able to see them).
4. The goal is to get the strips in order so that the shortest strip is under number 1, up to the longest strip under number 5.
5. Class members are called on to choose two numbers and the arranger shows the class those strips. The class chooses between the options of switching the positions of the strips or leaving them in their same positions.
6. A second student is selected to be scorekeeper. This student tallies the number of turns it takes to get the strips in the proper order.

7. When over half the class believes the strips are in order, the arranger places them on top of the box to show the results.

8. Select a new arranger and scorekeeper and try to get a lower score.

9. Discussion might address the following points:

   a. A computer sorting with the method in this demonstration would always compare the pairs in this order: 1-2, 1-3, 1-4, 1-5, 2-3, 2-4, 2-5, 3-4, 3-5, 4-5 for a total of 10 comparisons.

   b. Is it easier once you have seen the strips and know about how long the shortest and longest are? The computer using this method would not know that. It would always do all 10 comparisons regardless of how many times it compared them.

OVERVIEW OF LESSON 4 Selecting Records

Bloom Level 2—Comprehension
A valuable feature of database programs is their ability to limit the number of records displayed. Data analysis is simplified when superfluous information can be removed. Database programs make this possible. You set the criteria for the records you want displayed and those that don't meet the criteria are automatically hidden from view. For example, if you only want to look at the Western states only in a STATES data file, or perhaps only those states with populations over two million, you can easily limit the records displayed.

TERMS TO DEFINE

Limiting Field	The field you choose to limit will be the one containing information you already know. For example, if you want to know something about Alaska, you would limit the "State" field because you already know what you want to find there—Alaska.
Comparison Information	The word, phrase, or number that describes which entries in the limiting field will determine the records you want to display or hide.
Limiter	Fourteen choices of ways to compare entries in the "limiting field" with the "comparison information" you typed in. These limiters include: equals, is greater than, is less than, is not equal to, and so forth. The transparency master LIMITERS (page 55) have examples of how each of these limiters works.
Tiers	Microsoft *Works* allows the records that are displayed (or printed) to be limited by up to six different selections or tiers. For example, in order to: "Display the records of all states in the west or south or with density under 100," the first tier is "west," the second is "south" and the third is "density under 100." All records that meet *any one* of the criteria in an OR selection like this will be displayed. On the other hand, in an AND selection, only the records that meet *all* the criteria will displayed.

When students begin selecting records, they will find that the most commonly used ones are self-explanatory. What they need is more experience using them. A worksheet like SELECT (page 58) of the STATES unit can give them that practice. Demonstrate answering one or more of the questions on SELECT on a large screen display before assigning students to computers. The steps for selecting records (see *Using Microsoft Works*, pp. 166-171) are:

1. Choose Record Selection from the Organize menu.
2. Highlight the limiting field in the left box (you may need to scroll). Press RETURN.
3. Choose the limiter from the right hand box. Press RETURN.
4. Type comparison information (unless you are limiting with blank fields). Press RETURN.

5. Click on Select or, to make a second tier selection, click on Install Rule. When using multiple tiers, begin each by clicking "And" to further limit the search or "Or" to expand it. Click on Select when done.

6. Check the records that are displayed.

Assign students to computer(s) to do SELECT or a similar worksheet. Be sure to debrief when students have completed the assignment (see page 5 of the Introduction for more on debriefing).

LESSON 4 Selecting Records

OBJECTIVE

Student partners will design and perform database searches to select records that will help them answer questions on a worksheet.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration and one or more for student use.

MATERIALS REQUIRED

1. Overhead projector.
2. Transparencies of:

   MOVIE MONEY SAMPLE FILE (page 53)
   SELECT RECORDS 1 (page 54)
   LIMITERS (page 55)
   SELECT RECORDS 2 (page 56)
   SELECT (page 57)

3. One copy of SELECT (page 58) for each student.

PREPARATION BEFORE CLASS

1. Place one copy of Microsoft *Works* and one STATES data disk beside each computer.
2. Make partner assignments and a schedule for computer use.

PRESENTATION

1. *Introductory activity*: Review *file, record, field*, and *entry* using the MOVIE MONEY SAMPLE FILE transparency, which shows a file of the top box office movies listed two different ways: alphabetically and by how much they earned. Discuss the uses of these two arrangements.
2. *Instruction:* "There are three ways to change the data file to make it easier to get information from it." Write on the board and discuss the differences:

   ARRANGE RECORDS = PUT IN ORDER
   FIND RECORDS = CHOOSE RECORDS THAT CONTAIN A CERTAIN WORD
   SELECT RECORDS = ONLY PICK CERTAIN RECORDS

Note: The FIND command is not used in this unit, but if you want to demonstrate to students how it works, you could give them an example using the LIMITERS 1 transparency: "We can call up all of the records with 1977 in them. Which would you get?" Demonstrate by selecting **Find Field** from the Organize Menu (or pressing Command-F), typing 1977, deselecting the "Search text fields only" option, and pressing RETURN. What records would you get if you tried to find all the records with 80 in them?" (There are three 80's in the dollars field and one in the year field.)

3. "In this lesson you are going to learn to SELECT RECORDS."

4. Have a student read from the chalkboard what is meant by SELECT RECORDS (only pick certain records). "In the MOVIE MONEY file, for example, we could select only the records of movies made in 1978, or ones that were made before 1980, or those that made more than 100 million dollars, or even those that were made before 1980 *and* made more than 100 million dollars."

5. Place the SELECT RECORDS 1 transparency on the overhead.

6. "With Microsoft *Works* and the STATES data file, if you choose **Record Selection** from the Organize menu, this is what you will see on the screen. Tell me what you see." Have the students describe the various boxes on the screen and ask them to predict what will be done with them.

7. "The box on the right contains a set of words and phrases called *limiters*. A limiter is a word or phrase that will limit the records on a screen or in a report. There are 14 of them in all, though only five are shown on the screen at a time." Use the LIMITERS transparency to discuss each limiter in terms of the MOVIE MONEY file. The chart on the bottom of the transparency refers to the data on the top. The first item in the chart shows that when limiting selections in the *Movie* field to those that equal *E.T.*, only record number 15 will be displayed. (An asterisk in the SEQUEL field means that the movie listed *is* the sequel.)

8. Discuss how limiters might be used with the STATES file. For example, *equals* could limit the selection to Nebraska, *is greater than* could limit the selection to those with populations above 2 million, etc.

9. Place the SELECT RECORDS 2 transparency on the overhead. Cover the bottom half of the transparency.

10. "If we highlighted ***begins with*** as our limiter and typed the letter 'N' as the comparison information, this is what we would get on the screen." Have the students describe the change.

11. Uncover the bottom half of the transparency. "And finally, if we click **Select**, the results of the search will appear looking like this." Discuss.

12. Place the SELECT transparency on the overhead projector. "This is today's assignment. Each group (or student) will get a worksheet like this."

13. "To find the answers, you *could* just browse through the data file, but if you did it that way, you would not finish this assignment in the time you will be allowed. Perhaps there is a faster way. Let's look at the first problem. Browsing, we would eventually find the answers, but only after looking at Alabama, Alaska, Arizona, and so on in order. The faster way is to use the SEARCH mode to answer question Number 1. Find the capital of Kansas."

14. In SEARCH, the field you choose to select will be the one containing what you already know. For example: If you want to know something about Alaska, search on the STATE field because you already know what will be there—Alaska. If you want to know what states produce oil, search in the MINING PRODUCTS field because you already know that it will contain OIL.

    Note: When using equals as a limiter, the match between the entry and the comparison information must be exact. Problems finding certain records sometimes arise with misspellings or when an extra space or forgotten extra character is in the field being limited. To prevent these problems it is often possible to use begins with instead of equals.

15. "What field will we select for Number 1 on the worksheet?" (*State*). "What limiter will we use?" (*equals* or *begins with*). "What comparison information should we enter?" *(Kansas or Kan or Ka)*. Demonstrate on the computer, and fill in the answer on the transparency. (See Appendix D, page 162, for answers.)

16. Use the computer to answer one or two more questions from the worksheet.

    Note: Show students how to clear the previous selection by clicking on **Delete Rule**. Otherwise they will simply add their next selection to the previous one, creating a two-tiered search.

17. Assign partners. Pass out the SELECT worksheet. Answer any questions about the assignment. Have them fill out the first three columns before you assign students to computers. (For some classes you may want to fill out the first three columns as a whole-class project.)

NOTES ON *SELECT* QUESTIONS:

number 1:	Using the limiter contains will call up the record of Arkansas in addition to Kansas.
number 6:	The abbreviation for Mid-Atlantic is MA.
number 7:	Use a two-tier search: STATE EQUALS NORTH CAROLINA OR STATE EQUALS GEORGIA.
number 9:	The comparison information will be the answer to number 8.

18. It may be helpful to stress to students that they will be using **Record Selection** *not Sort* (from the Organize menu) on the SELECT worksheet.

19. Circulate to help students with their searches.

20. Follow-up activities:

    a. Correct worksheets and discuss the answers.

    b. Review the difference between Arranging and Selecting Records. Use examples like: Would you Arrange or Select Records to list states with populations over two million? Would you Arrange or Select Records to find the least densely populated state?

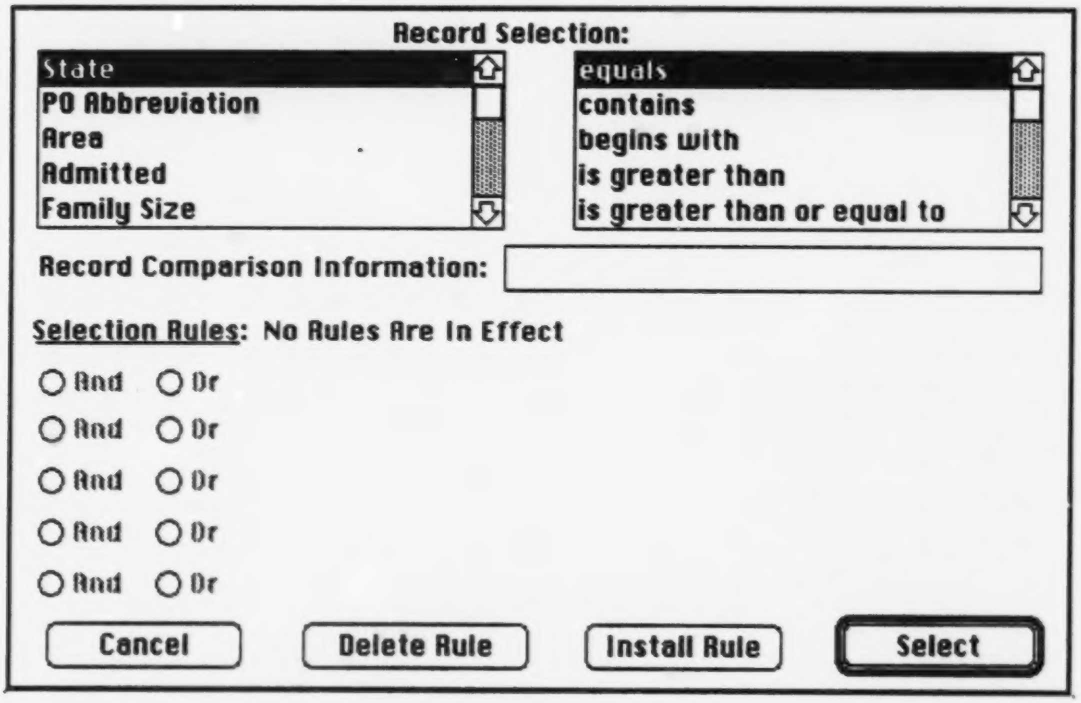
MOVIE MONEY Sample File

Movie	*Year*	*$ Million*
Animal House	1978	71
Back to the Future	1985	102
Beverly Hills Cop	1984	108
Close Encounters of the Third Kind	1977	83
E.T.	1982	228
Ghostbusters	1984	128
Gone With the Wind	1939	78
Grease	1978	96
Gremlins	1984	80
Indiana Jones and the Temple of Doom	1984	109
Jaws	1975	130
Raiders of the Lost Ark	1981	116
Rambo: First Blood Part II	1985	80
Return of the Jedi	1983	168
Rocky IV	1985	76

Movie	*Year*	*$ Million*
E.T.	1982	228
Star Wars	1977	193
Return of the Jedi	1983	168
The Empire Strikes Back	1980	142
Jaws	1975	130
Ghostbusters	1984	128
Raiders of the Lost Ark	1981	116
Indiana Jones and the Temple of Doom	1984	109
Beverly Hills Cop	1984	108
Back to the Future	1985	102
Grease	1978	96
Tootsie	1982	95
The Exorcist	1973	89
The Godfather	1972	86
Close Encounters of the Third Kind	1977	83

(Source: *Information Please Almanac*, 1988)

SELECT RECORDS 1



Record Selection: State equals

Record Comparison Information:

Selection Rules: No Rules Are In Effect

Record Selection:
State
PO Abbreviation
Area
Admitted
Family Size
equals
contains
begins with
is greater than
is greater than or equal to
Record Comparison Information:
Selection Rules:
○ And ○ Or
○ And ○ Or
○ And ○ Or
○ And ○ Or
○ And ○ Or
Cancel
Delete Rule
Install Rule
Select

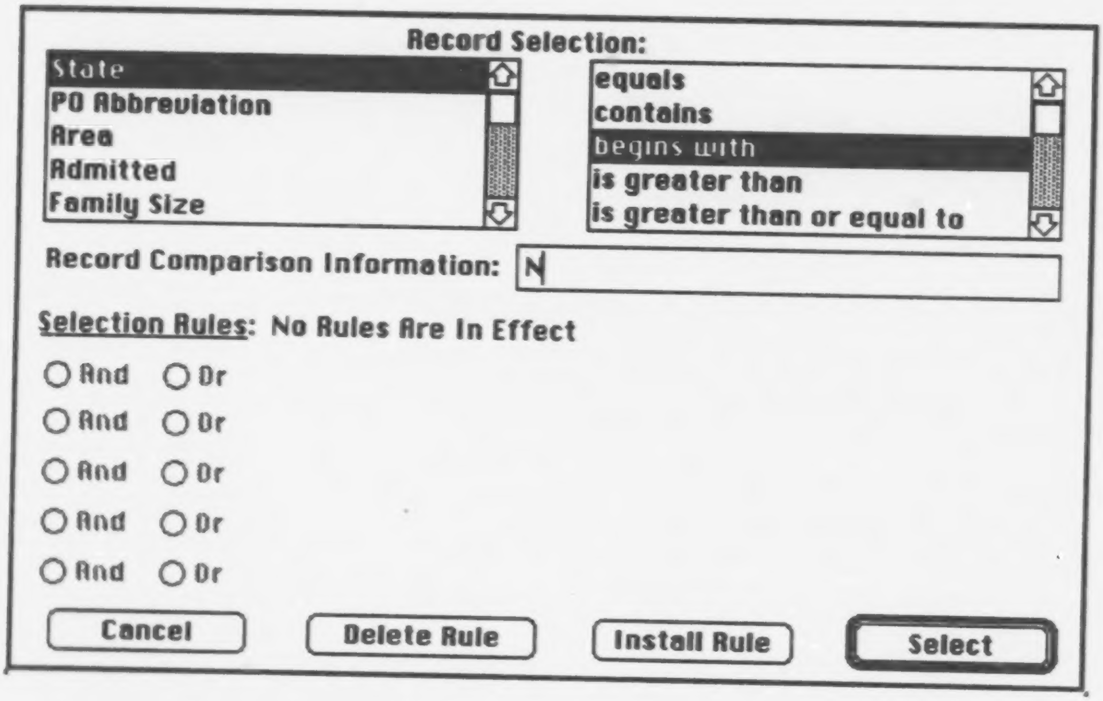
LIMITERS

Movie		*Year*	*$ Mill*	*Rating*	*Minutes*	*Stars*	*Squl?*
1	Gone With the Wind	1939	78		231	FM	
2	The Sound of Music	1965	80	G	174	F	
3	The Godfather	1972	86	R	171	M	Yes
4	The Exorcist	1973	89	R	122	F	Yes
5	The Sting	1973	78	PG	129	M	Yes
6	Jaws	1975	130	PG	124	M	Yes
7	Star Wars	1977	193	PG	121	FM	Yes
8	Close Encounters	1977	83	PG	152	M	
9	Saturday Night Fever	1977	74	R	118	M	Yes
10	Grease	1978	96	PG	110	FM	Yes
11	Superman	1978	83	PG	144	M	Yes
12	Animal House	1978	71	R	109	M	Yes
13	The Empire Strikes Back	1980	142	PG	124	FM	Yes
14	Raiders of the Lost Ark	1981	116	PG	115	FM	Yes
15	E.T.	1982	228	PG	115	M	
16	Tootsie	1982	95	PG	110	M	
17	Return of the Jedi	1983	168	PG	132	FM	Yes
18	Ghostbusters	1984	128	PG	107	M	Yes
19	Indiana Jones - T.D.	1984	109	PG	118	M	Yes *
20	Beverly Hills Cop	1984	108	R	105	M	Yes
21	Gremlins	1984	80	PG	106	M	Yes
22	Back to the Future	1985	102	PG	116	M	Yes
23	Rambo:First Blood Pt II	1985	80	PG	95	M	Yes
24	Rocky IV	1985	76	PG	91	M	Yes *
25	Top Gun	1986	82	PG	110	M	

(Source: *Information Please Almanac*, 1988)

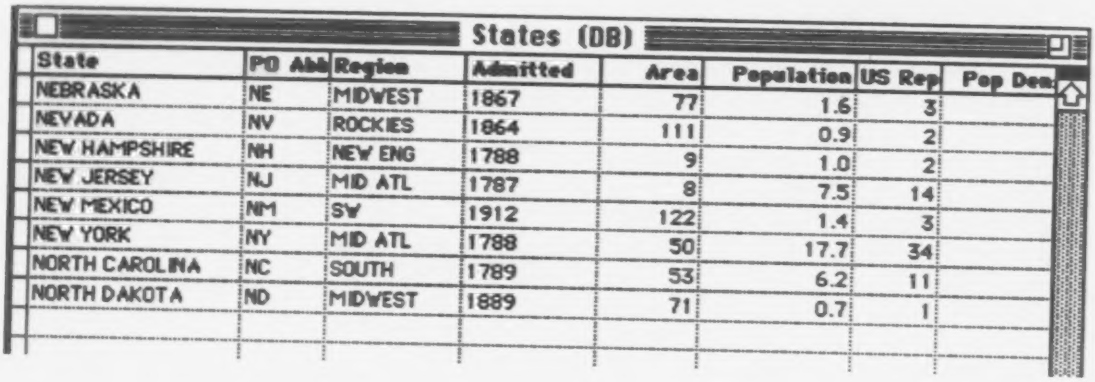
Limiting Category	*Limiter*	*Comparison Information*	*Records Displayed*
Movie	equals	E.T.	15
Movie	equals	E.T	none
$ Million	is greater than	200	15
Minutes	is less than	100	23, 24
Rating	is not equal to	PG	1, 2, 3, 4, 9, 12, 20
Sequel	is blank	-	1
Sequel	is not blank	-	3-7, 9-14, 17-24
Movie	contains	Ark	14
Movie	begins with	Ind	19
Sequel	ends with	*	19, 23, 24

SELECT RECORDS 2


Record Selection:
State
PO Abbreviation
Area
Admitted
Family Size
equals
contains
begins with
is greater than
is greater than or equal to
○ And ○ Or
○ And ○ Or
○ And ○ Or
○ And ○ Or
○ And ○ Or
Cancel
Delete Rule
Install Rule
Select

Record Comparison Information: N

Selection Rules: No Rules Are In Effect



States (DB)

State	PO Abb	Region	Admitted	Area	Population	US Rep	Pop Den
NEBRASKA	NE	MIDWEST	1867	77	1.6	3	
NEVADA	NV	ROCKIES	1864	111	0.9	2	
NEW HAMPSHIRE	NH	NEW ENG	1788	9	1.0	2	
NEW JERSEY	NJ	MID ATL	1787	8	7.5	14	
NEW MEXICO	NM	SW	1912	122	1.4	3	
NEW YORK	NY	MID ATL	1788	50	17.7	34	
NORTH CAROLINA	NC	SOUTH	1789	53	6.2	11	
NORTH DAKOTA	ND	MIDWEST	1889	71	0.7	1	

SELECT

NAME ____

QUESTION	CATEGORY TO SELECT	LIMITER	COMPARISON	ANSWERS
1. What is the capital of Kansas?				
2. What states have an average income per person of $11,000 (11)?				
3. Birmingham is the largest city of what state?				
4. What is the largest city in Pennsylvania?				
5. How many states begin with the letter "O"?				
6. List the states in the Mid-Atlantic region.				
7. Which state is larger: North Carolina or Georgia?				
8. When was Washington admitted to the U.S.?				
9. What states were admitted after Washington?				

OVERVIEW OF LESSON 5 Planning and Printing the Reports

Bloom Level 3—Application
Having practiced browsing through the file, arranging data, and selecting records, students can begin using the file to print reports that will help them probe more deeply into the topic. The worksheet REPORT and its flip-side HOW TO PRINT (pages 64-65) make up a generic report printing guide that can be used throughout the unit on states. These worksheets can also be used for database units on other topics.

The first time students use REPORT, they should be doing an assignment made up by the teacher. (In the lesson on the following pages, the assignments ask the students to: "List the states in order of population density" and "Find the states that have eight U.S. Representatives.")

Explain to the students that to print useful reports, it is necessary to design reports that:

1. Include all fields needed to make the list or answer the question in the assignment.

2. Exclude fields and records that are not needed.

3. Change the width of each field to fit its entries.

4. Put the fields in an order that makes analysis easier.

Show students the HOW TO PRINT transparency so they will see that the instructions under "Designing the Report Format" will help them do all of the above.

Work through one question with REPORT on the overhead projector and a computer with a large screen display.

LESSON 5 Planning and Printing Reports with the Data File

OBJECTIVE

Student partners will design a database report to help them make a list or answer a question posed by the teacher. They will print the report and use the data in the report to support their answer(s).

COMPUTER(S) NEEDED FOR LESSON

One for demonstration and one or more for student use. Printer preferred but not required.

MATERIALS REQUIRED

1. Overhead projector.
2. Transparencies of:

   ANIMALS SAMPLE FILE (page 63)
   REPORT (page 64)
   HOW TO PRINT (page 65)

3. Duplicate worksheets with REPORT on one side and HOW TO PRINT on the other (pages 64-65). NOTE: Since these forms are used throughout the unit and can also be used with other database units, you may want to duplicate them in quantity.

PREPARATION BEFORE CLASS

1. Place one copy of Microsoft *Works* and one STATES data disk beside each computer.
2. Make partner assignments and a schedule for computer use.

PRESENTATION

1. *Introductory activity*: Use the ANIMALS SAMPLE FILE transparency to review searching. The top of the transparency shows the file in alphabetical order by "type." The bottom shows a two-tier search. Discuss first the interesting content of the file. Then discuss how the search was conducted and what other searches might be interesting.
2. *Instruction:* "With a database, reading the screen is not the only way to see the results of your searches. Many times it is more useful to print a report on paper. For practice, let's plan a report together to do the following problem:

   "List the states in order of their population density."

3. Place REPORT transparency on the overhead and use it to plan the search.

4. Fill out the top of the transparency as the class discusses and plans its report. *(1a. List the states in order of their population density. 1b. A list of all the states and the data in the density field. 2 . yes. 3. state, density. 4. density. 5. 9 to 0.)* (Note that, since you want all of the records in the list you will skip "a" through "e" in number 2.)

5. Demonstrate loading Microsoft *Works* and putting the STATES file on the desktop.

6. Place the HOW TO PRINT instructions transparency on the overhead projector. Follow the directions on the transparency to print a report, referring to the REPORT transparency as needed. Print it both to the screen and the printer to show students that the reports are identical.

   Note: The first few times students print reports they should follow the instructions on HOW TO PRINT step-by-step. It will not be long, though, before they will only need the instructions for reference.

7. Use the information on the printed report to answer the question on the bottom of the REPORT transparency that reads: *What did you learn from the report*? On the transparency write a statement the class can agree answers the question. Discuss.

8. "Today you and your partner are going to use the database and data file to answer the question: 'What states have 8 members in the U.S. House of Representatives?'"

9. Clean off the REPORT transparency. Demonstrate filling in the top of the sheet for the representative search. (One approach: 1b. *A list of the states with 8 Representatives and the data in the U.S. Representatives category*. 2. *No*. 2a. *U.S. Representatives*. 2b. *equals*. 2c. *8*. 2d. *No*. 3. *State, U.S. Representatives*. 4. *States*. 5. *A to Z*.)

   Note: Questions 2a through 2d require answers on this assignment because you probably do not want to print the records of all 50 states. The rule of thumb: limit the field for which you already know the entry. In the above example, we already know that the entry in the U.S. Representatives field will be "8." So the selection will be: "*U.S. Representatives equals 8*."

10. Assign partners. Pass out the REPORT worksheet. Answer any questions about the assignment.

11. Circulate to check students' plans. When they have a reasonable approach, assign or schedule them on the computer(s).

12. Help partners redesign their searches if the information they received from their searches was not helpful.

13. *Follow-up activity*: Discuss the REPORT worksheet. Discuss, too, the strategies students used and any problems they had.

ANIMALS Sample File

Animal	*Type*	*Surface*	*Lungs*	*Gills*	*Wings*	*Birth*
Salamander	Amphibian	Scales	Yes	Yes	No	Eggs
Frog	Amphibian	Scales	Yes	Yes	No	Eggs
Robin	Bird	Feathers	Yes	No	Yes	Eggs
Owl	Bird	Feathers	Yes	No	Yes	Eggs
Shark	Fish	Scales	No	Yes	No	Eggs
Halibut	Fish	Scales	No	Yes	No	Eggs
Bat	Mammal	Hair	Yes	No	Yes	Live
Dog	Mammal	Hair	Yes	No	No	Live
Platypus	Mammal	Hair	Yes	No	No	Eggs
Crocodile	Reptile	Scales	Yes	No	No	Eggs
Turtle	Reptile	Scales	Yes	No	No	Eggs

Selection *Type contains MAMMAL and Birth contains EGGS*

Animal	*Type*	*Surface*	*Lungs*	*Gills*	*Wings*	*Birth*
Platypus	Mammal	Hair	Yes	No	No	Eggs

(Source: *MECC Classification*)

REPORT A Planning Sheet for Printing List-type Reports

Name(s) ______________________________

1. a. Write your question, problem or hypothesis.

____

b. I want to print a list of ______________________________

and include data from these other fields: ______________________________

____

2. Do you want your list to contain every record in the file in your report (all 50 of the states for example)? Mark one. YES (skip a, b, c, d & e) NO

a. Which **field** do you want to limit? ______________________________

b. Which **limiter**? Circle one:

equals
contains
is greater than
is less than or equal to
does not begin with
does not end with
begins with

is not blank
ends with
is greater than or equal to
is less than
does not contain
is blank
is not equal to

c. What is the **comparison information**? ______________________________

d. Do you want a "second tier" selection? YES NO (if no, skip to #3)

field ______________ limiter ______________ comp info ______________

e. Do you want any more tiers? YES NO (if no, skip to #3)

field ______________ limiters ______________ comp info ______________

3. List the fields you want to include in the report.

1st field ______________ 2nd field ______________

3rd field ______________ 4th field ______________

4. Which field do you want your list sorted by? ______________________________

5. What kind of order? (Circle one.) A-Z Z-A 0 to 9 9 to 0

What did you learn from the report? What is the answer to your question or problem? Does your report support your hypothesis? Explain.

HOW TO PRINT — Instructions for Printing List-type Reports

SORTING

Place the cursor on the field you want to arrange. (See REPORT item # 4).
Select **Sort** from the Organize Menu (or press Command-A).
Choose kind of order. (See REPORT item # 5). Press RETURN.

DESIGNING THE REPORT FORMAT

Choose **New Report** from the **Report** menu (unless you already have a format saved).
Arrange the fields to print by click-hold-dragging to the left or right the "hand" cursor on the title of any field you wish to move. (See REPORT item #3 for desired order).
Widen or narrow fields by click-hold-dragging on the line between field titles.

SELECTING RECORDS

If you are printing all records (see REPORT item # 2) and no selection rules are in effect, skip this section. Go to PRINTING below.
Choose **Record Selection** from the **Organize** menu.
Highlight the field you want to use to select records. (See REPORT item # 2a).
Choose the limiter you want from the right box. (See REPORT item #2b).
Type the comparison information for that field. (See REPORT item # 2c).
Click **Select** if you are done or click **Install Rule** to do a multiple tier selection. (See REPORT items # 2d and 2e).
Click **Select** when last tier is entered.

PRINTING

Choose **Print** from the File menu (or press Command-P).
Choose the correct printer or the screen. (See REPORT item #6).
Type the date if you wish or press RETURN.
Check options displayed and the printer.
Click **OK** or press **RETURN** to print.
Use your report to complete the planning worksheet.

OVERVIEW OF LESSON 6 Including More Information in Reports

Bloom Levels 3 and 4—Application and Analysis

When you want to compare information, it is useful to include more information in a report than just those fields that are used to arrange and select records. If, for example, you have a list of states arranged by the number of U.S. Representatives, it would be instructive to add the population of each state to the report. Students can then explore the relationship between the two fields. The lesson on the following pages uses a class discussion of REPRESENTATIVE REPORT (page 71) to introduce this skill.

Demonstrate planning a report to include more than two fields as in the lesson on the following pages, and then have student partnerships use the REPORT worksheet (page 64) to execute a plan on the computer(s). Debrief.

LESSON 6

Plan Reports to Answer Questions and Include More Information in Reports

OBJECTIVES

Student partners will design database reports that include several fields in order to help them solve problems involving finding relationships between fields. They will perform the searches, print them, and use the data to support their answers.

COMPUTER(S) NEEDED FOR LESSON

One or more for student use. Printer preferred but not required.

PREPARATION BEFORE CLASS

1. Overhead projector.
2. Prepare transparencies of:

   REPRESENTATIVE REPORT (page 71)
   REPORT (Can be reused from Lesson 5)
   HOW TO PRINT (Can be reused from Lesson 5)

3. Duplicate worksheets with REPORT on one side and HOW TO PRINT on the other (from Lesson 5, pages 64-65).
4. Place one copy of Microsoft *Works* and the STATES data disk beside each computer.

PRESENTATION

1. *Introductory activity*: Place REPRESENTATIVE REPORT transparency on overhead ***covering the bottom section of the report and the population column***. "Does this look something like the report you printed? Can you explain any differences?"
2. "Did anyone notice whether these states have anything in common besides their number of representatives?" (*Some students may know that the number of representatives depends on population*). Whether or not students know any other points in common, uncover the population column of the transparency—***but not the bottom half***.
3. "Another thing you can do with database reports is include other information in the report besides the data involved in the search. This report includes the population of the states. With this information on the report, can you see something these states have in common?" (*Their populations are similar*). Discuss why. *(The House of Representatives has proportional representation—the higher the population, the more representatives a state is allotted.)*
4. Have the students speculate about what they would find if they printed a similar report of those states with seven, eight, and nine representatives. After this discussion, uncover the bottom section of the report and ask students to analyze it in view of their predictions.

5. *Instruction:* "As you can see, we can design a report to show whatever information we need. And we can use this information to *show relationships* between the different fields we list."

6. "Today we will use the ability of a database to print other information to help solve a problem. Here's the situation: (Write it on the chalkboard).

    Situation: "I want to move to a state that has lots of forest land and a low population density."

    Discuss why somebody might want to do this. *(Nature lover, needs elbow room, etc.)*

7. Place transparency of REPORT on overhead and distribute REPORT/HOW TO PRINT worksheets to partners.

8. Have students write the following problem for Number 1 on their worksheets.

    Problem: Name the states with less than 25 inches of rainfall and population densities of less than 25 people per square mile.

9. Write the problem on the transparency.

10. Discuss possible approaches. Answer questions.

11. Have students plan their searches and reports before they go to the computer.

12. Circulate to check students' planned searches. When they have a reasonable approach, assign partners to a computer or put them on the schedule.

13. Help partners redesign their reports if the information they received from their searches was not useful.

14. *Follow-up activity*: Discuss and compare results. Discuss other qualities a person might want to find in a state. How would they change the list?

REPRESENTATIVE REPORT

File: STATES
Report: REPS
Selection: US Representatives equals 8

State	*U.S. Representatives*	*Population (in millions)*
LOUISIANA	8	4.5
MARYLAND	8	4.3
MINNESOTA	8	4.2
WASHINGTON	8	4.3

File: STATES
Report: REPS
Selection: US Representatives is greater than 6 and U.S. Representatives is less than 10

State	*U.S. Representatives*	*Population (in millions)*
ALABAMA	7	4.0
KENTUCKY	7	3.7
LOUISIANA	8	4.5
MARYLAND	8	4.3
MINNESOTA	8	4.2
WASHINGTON	8	4.3
MISSOURI	9	5.0
TENNESSEE	9	4.7
WISCONSIN	9	4.8

OVERVIEW OF LESSON 7

Generating Questions to Answer with Printed Reports

Bloom Levels 3 and 4—Application and Analysis
To foster independent use of the data file, it is worthwhile for students to brainstorm their own questions and choose which ones they want to answer. This gives students more ownership of their work as they practice answering questions with the help of printed reports. To assist students in generating questions, **starters** like those on the LIST/QUESTION STARTERS transparency (page 78) are helpful. A list of fields in the data file also helps generate ideas. Notice that this type of question requires students to examine relationships, a step up in the hierarchy of thinking skills.

When a set of lists and questions is on the board, allow students to choose one or more (as time allows) to answer with the computer, the data file, and the REPORT worksheet (page 64).

LESSON 7

Generating Questions and Answering Them With Printed Reports

OBJECTIVE

Students will generate questions about the states and will use the STATES data file to find the answers to factual questions and explore the capabilities of databases.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration and one or more for student use. Printer preferred but not required.

MATERIALS REQUIRED

1. Overhead projector.
2. Duplicates of worksheet REPORT (page 64 in Lesson 5).
3. Transparencies of:

   MOUNTAINS SAMPLE FILE (page 77)
   LIST/QUESTION STARTERS (page 78)

PREPARATION BEFORE CLASS

1. Place copies of Microsoft *Works* and the STATES data disk beside each computer.
2. Make partner assignments and a schedule for computer use.

PRESENTATION

1. *Introductory activity:* Ask the students to guess what continent has the highest mountains in the world. Place the MOUNTAINS SAMPLE FILE on the overhead projector. Have the students look it over and discuss the data. The top report lists the 15 tallest peaks, while the bottom report lists 15 of the "lower" mountains (those just over 20,000 feet high).

   NOTE: You may want to tell students now (or later) that this is an easier-than-usual data analysis. Most will not be so clear.

2. *Instruction:* Place the LIST/QUESTION STARTERS transparency on the overhead.
3. Have students use the question starters on the transparency to come up with a list of questions for you to put on the chalkboard. (Examples: List all the states in order of their Number of Representatives. What is the major mining product of West Virginia? What states have dates in the 1700s in the *Admission* field?)
4. Have student partners pick one or more questions they want to try to answer with the file.

5. Distribute REPORT worksheets. Have students fill out the top section.

6. If the students seem unclear on how to begin, ask a volunteer to demonstrate a computer search for one of the questions.

7. Assign or schedule computers.

8. *Follow-up activity*: Discuss interesting results of student's searches and the answers to their questions. If students had difficulty, have them state the problem and ask their fellow students for advice.

MOUNTAINS

Sample File

Name	*Height in Feet*	*Continent*
Everest	29,028	Asia
Kanchenjunga	28,250	Asia
Goodwin Austen (K2)	28,208	Asia
Lhotse	27,890	Asia
Makalu	27,790	Asia
Dhaulagiri	26,810	Asia
Manaslu I	26,760	Asia
Cho Oyu	26,750	Asia
Nanga Parbat	26,660	Asia
Annapurna I	26,504	Asia
Gasherbrum I	26,470	Asia
Broad Peak	26,400	Asia
Gasherbrum II	26,360	Asia
Gosainthan	26,291	Asia
Gasherbrum III	26,090	Asia

Name	*Height in Feet*	*Continent*
Antofalla	21,129	South America
Coropuna	21,079	South America
Cuzco	20,995	South America
Toro	20,932	South America
Parinacota	20,768	South America
Chimboraso	20,702	South America
Salcantay	20,575	South America
General Belgrano	20,505	South America
Chani	20,341	South America
Caca Aca	20,328	South America
McKinley	20,320	North America
Vudor Peak	20,118	Asia
Condoriri	20,095	South America
Solimana	20,069	South America
Nevada	20,023	South America

(Source: *Information Please Almanac*, 1988)

LIST/QUESTION STARTERS

1. List all of the states in order of
2. What is the ______________________________ of ____________________________?
3. What states have ______________________________ in the ______________________field?

FIELDS IN THE STATES DATA FILE

State
PO Abbreviation
Region
Admitted
Area
Population
US Representatives
Pop Density
Pop Change %
Forest Acres
Income
Unemployment %
Urban Pop %
Minority Pop %
Family Size

Capital
Largest City
  Pop LC
  Jan High Temp
  Jan Low Temp
  July High Temp
  July Low Temp
  Elevation
  Rainfall

Manufactured Product
Agricultural Product
Mining Product

OVERVIEW OF LESSON 8 Introduction to Hypothesis Testing

Bloom Level 4—Analysis
As students begin to probe independently into the data file, they can speculate about relationships, formulate hypotheses, and test their hypotheses by planning and printing reports. Students who are accustomed to having one correct answer to a question or one correct approach to solving a problem will need experience to become comfortable with a process that has many possible outcomes and approaches. Each student in the class could develop a different hypothesis to explain the same data. The conclusions they draw could be quite different and still be supportable. The answer is not the important thing—the ability to develop strategies to solve problems with a tool like a database is the objective.

The lesson on the following pages illustrates how to help students begin learning to generate and test hypotheses with the following activities:

1. Define hypothesis.
2. Model the generation and testing of a hypothesis.
3. Whole-class generation and testing of a hypothesis.
4. A practice worksheet like HYPOTHESES (page 84).
5. Debrief.

LESSON 8 Introduction to the Hypothesis Testing

OBJECTIVE

Students will learn what hypotheses are and how to design and carry out searches to gather data to test hypotheses.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration.

MATERIALS REQUIRED

1. Overhead projector.

PREPARATION BEFORE CLASS

1. Prepare transparencies of:

   LIFE EXPECTANCY SAMPLE FILE (page 83).
   REPORT (Can be reused from Lesson 5).

2. Duplicate a copy for each student of:

   MEANINGS (page 32 in Lesson 2).
   HYPOTHESES (page 84)

3. Load Microsoft *Works* and add the STATES file to the desktop.

PRESENTATION

1. *Introductory activity*: Ask the students to guess who lives longer in most countries, men or women? In what countries do people have longer life expectancies? Show the class the LIFE EXPECTANCY SAMPLE FILE. The top report is the 15 countries with the highest male life expectancy and the bottom report lists the lowest. Discuss the data and the value of putting it in this form. Is there any other information or arrangement of information that would be interesting or helpful?

2. *Instruction:* Discuss the term: **hypothesis**: "One way to try to answer a question is to *guess* what the answer might be and then try to verify whether the guess is accurate. This guess is called an hypothesis (plural = hypotheses)."

3. Pass out MEANINGS at this time for reference. "In this and the next lesson we are going to use our STATES data file to test some hypotheses. Let's make up a hypothesis to help answer this question:

Question: "What states do you think have the highest income and what region of the country do you think they are in?"
Have the students speculate on what region of the country has states with the highest incomes. Form a consensus or vote on it. (Choices in the STATES file are: New England, Mid-Atlantic, South, Midwest, Rockies, Southwest, West.)

4. Place REPORT transparency on overhead. Under Number 1 write the statement: "I think most of the states with high incomes are in the ______(*whatever region the class predicts*) region of the U.S."

5. "This is our *hypothesis*. How can I use the States data file to test it?" *(A possibility: arrange by INCOME and include REGION in the report so you can see where top states are located.)* Discuss possibilities and agree on an approach.

6. Use the transparency to guide your use of the computer; fill in the blanks on the transparency.

7. Discuss the results of the search. "Does our hypothesis seem to be accurate?" "If not, how could we change the hypothesis to make it more accurate? Is this an easy data analysis?"

   Important: The students need to realize that their findings are not going to *prove* that their hypotheses are true. Rather, the data they collect will *support* or *not support* the hypothesis.

   Agree on a statement to write on the bottom of the REPORT transparency. Stress that this section of the paper is the most important part.

8. *Discuss*: All the database can do is provide information. We must do the **analysis** that gives meaning to the information.

9. If you have time, have the class make up one more question and a hypothesis to answer it. Use the REPORT transparency and the STATES data file to try to establish the accuracy of the hypothesis.

10. Assign the HYPOTHESES worksheet as an in-class or homework assignment. You may want to do number 1 together.

11. *Follow-up activity*: Correct and discuss the HYPOTHESES worksheet.

LIFE EXPECTANCY Sample File

Country	*Male L.E.*	*Female L.E.*
Iceland	73.5	79.5
Sweden	73.4	79.4
Japan	73.0	78.0
Norway	72.5	79.7
Denmark	72.3	77.4
Cyprus	72.3	76.0
Israel	72.1	75.7
Netherlands	72.0	78.0
Greece	72.0	76.0
Ireland	72.0	72.0
United States	71.6	76.3
Cuba	71.0	74.0
Barbados	70.8	70.8
New Zealand	70.6	76.6
Switzerland	70.3	76.2

Country	*Male L.E.*	*Female L.E.*
Malawi	42.0	45.0
Kampuchea	42.0	44.9
Burkina Faso	42.0	42.0
Ghana	41.9	45.1
Chad	41.5	43.9
Angola	40.6	42.9
Yemen, South	40.6	42.4
Ethiopia	40.0	40.0
Afghanistan	39.9	40.7
Laos	39.1	41.8
Mali	39.0	42.0
Yemen	37.3	38.7
Guinea-Bissau	35.0	35.0
Gambia, The	32.0	34.0
Gabon	25.0	45.0

(Source: *World Almanac and Book of Facts*, 1987)

HYPOTHESES

Name(s) ____

Finish each of the following statements with your guess of what the data will show (your hypothesis). Then explain what would be in the report you would print to support your hypothesis.

1. States that have the slowest population growth are most likely to be in what region of the country? (West, Rockies, Southwest, Midwest, Northeast, Mid-Atlantic, or South)

   Describe a report that would test your hypothesis.

2. Most states with high elevations have low ______________________________

   Describe a report that would test your hypothesis.

3. States with low populations have high ______________________________

   Describe a report that would test your hypothesis.

4. Fast growing states have large ______________________________

   Describe a report that would test your hypothesis.

5. States admitted late to the U.S. are in the ______________________________ region.

   Describe a report that would test your hypothesis.

Bloom Level 4—Analysis

Students should now be ready to begin to use the database independently to question, speculate, formulate, and test hypotheses; in short, explore meanings beneath the surface of the data. It can help to begin by displaying and discussing "starters" like those on the HYPOTHESIS STARTERS transparency (page 91).

A class brainstorming session should produce a good list of prospective hypotheses. Students can evaluate each hypothesis by asking the following questions about it and eliminating those hypotheses that are not satisfactory:

- Would the results be interesting?
- Would they be important?
- Is the necessary information in the data file?

Before students choose one of the hypotheses to test, it is important for them to understand that they are not *proving* the hypothesis is true. Rather, the data they collect will *support* or *not support* the hypothesis. Proof would require scientifically controlled and verified research that is not possible without researching beyond the data in the file.

Many of the reports generated by the groups will yield data that is ambiguous or difficult to analyze. Lesson 10 will teach some methods for dealing with this kind of data. Ask those groups having problems with unclear results to save their reports for analysis after Lesson 10.

Have each partnership choose one or more hypotheses to test using the STATES data file and the REPORT worksheet (page 64).

OBJECTIVE

Students will formulate hypotheses and will design and carry out searches of the STATES data file to test their hypotheses.

COMPUTER(S) NEEDED FOR LESSON

One or more for student use. Printer preferred but not required.

MATERIALS REQUIRED

1. Overhead projector.

2. Transparencies of:

   LITERACY SAMPLE FILE (page 89)
   OCEANS AND SEAS SAMPLE FILE (page 90)
   HYPOTHESIS STARTERS (page 91)

3. Duplicate REPORT worksheet (page 64 in Lesson 5).

PREPARATION BEFORE CLASS

1. Place copies of Microsoft *Works* and the STATES data disk beside each computer.

PRESENTATION

1. *Introductory activities:* Place the LITERACY SAMPLE FILE on the overhead. "The top of this sheet shows the most literate countries in the world and their incomes per person per year. On the bottom we have the least literate countries. What can you tell me about the relationship between income and literacy?" (**Note:** *Clearly there is a relationship, but it has to be qualified because of the exceptions: North Korea, U.S.S.R., and Saudi Arabia* .) "Can anyone think of an hypothesis to explain why Saudi Arabia has a lower literacy rate than North Korea?" Discuss how these hypotheses could be tested.

2. Place the OCEANS AND SEAS SAMPLE FILE on the overhead. Ask the the students whether there is a relationship between the depth of a body of water and its area. Again there is a general relationship that must be qualified. Discuss how one of the most interesting things to do with data like this is to play detective and test hypotheses about why some of the records don't fit the relationship. For example, what can explain the fact that Hudson's Bay is more shallow even though it is much bigger than the Black Sea?

3. *Instruction:* "Today, with a partner, you will be thinking up your own hypotheses about data in the States Data File and trying to test them with database reports like the sample reports we just looked at."

4. Place HYPOTHESIS STARTERS transparency on overhead. Pair the students and have each pair look over the fields and use the hypothesis starters to come up with four or five questions and hypotheses they might want to explore. They should jot them down on scratch paper.

5. Have students choose one question and hypothesis from their list by thinking about the following questions: (Write them on the chalkboard).

   Would the results be interesting?
   Would they be important?
   Is the necessary information in the data files?

   Note: Defining ***high***, ***medium***, and *low* is often easier when the list is sorted by one of the fields being compared. That way the numbers at the top of the list are high, the bottom ones are low (or vice versa), and the middle are medium. *Arrange* (Open Apple-A) with the cursor of the field by which you want the list sorted.

6. Answer students' questions, pass out REPORT worksheets, allow partners to meet to fill out the top part of the worksheet with the hypothesis they have chosen and their plan for using the database to test it. Schedule computer(s) as students generate hypotheses and finish planning searches.

7. Help students revise and refine their reports if the information they get is not helpful.

8. **Important**: Debrief with partners to be sure the analyses they have written on the bottom of the worksheet are complete and accurate.

9. If time permits, have the students generate other hypotheses and print more reports to examine areas of the curriculum that have not yet been covered. Guide groups toward looking at relationships that will open worthwhile topics for discussion.

10. Have the students present their findings to the class.

Country	*Literacy*	*Income*
Switzerland	100%	$14,408
Norway	100%	$12,432
Luxembourg	100%	$10,444
Australia	100%	$9,960
Iceland	99%	$9,000
U.S.S.R.	99%	$2,600
United States	99%	$11,675
U.K.	99%	$7,216
Sweden	99%	$14,821
New Zealand	99%	$7,363
Nauru	99%	$21,400
Korea, North	99%	$570
Japan	99%	$8,460
Ireland	99%	$4,750
Germany, West	99%	$11,142
Germany, East	99%	$8,000

Country	*Literacy*	*Income*
Saudi Arabia	15%	$11,500
Ethiopia	15%	$117
Comoros	15%	$240
Chad	15%	$73
Mozambique	14%	$220
Gambia, The	12%	$330
Benin	11%	$310
Senegal	10%	$342
Mali	10%	$140
Afghanistan	10%	$168
Guinea-Bissau	9%	$170
Niger	8%	$475
Burkina Faso	7%	$180
Somalia	5%	$500
Bhutan	5%	$100

(Source: *World Almanac and Book of Facts*, 1987)

OCEANS AND SEAS

Sample File

Name	*Area in Sq. Miles*	*Avg. Depth (in feet)*
Pacific Ocean	64,186,300	12,925
Atlantic Ocean	33,420,000	11,730
Indian Ocean	28,350,500	12,598
Arctic Ocean	5,105,700	3,407
South China Sea	1,148,500	4,802
Caribbean Sea	971,400	8,448
Mediterranean Sea	969,100	4,926
Bering Sea	873,000	4,893
Gulf of Mexico	582,100	5,297
Sea of Okhotsk	537,500	3,468
Sea of Japan	391,100	5,468
Hudson Bay	281,900	305
East China Sea	256,600	620
Andaman Sea	218,100	3,667
Black Sea	196,100	3,906
Red Sea	174,900	1,764
North Sea	164,900	308
Baltic Sea	147,500	180
Yellow Sea	113,500	121
Persian Gulf	88,800	328
Gulf of California	59,100	2,375

(Source: National Geographic Society)

HYPOTHESIS STARTERS

1. States that have (high, medium, low)____________________have (high, medium, low)____________________.

2. States in the ____________________ region of the U.S. have (high, medium, low) ____________________.

3. States producing ______________________ have (high, medium, low) ____________________.

FIELDS IN THE STATES DATA FILE

State
PO Abbreviation
Region
Admitted
Area
Population
US Representatives
Pop Density
Pop Change %
Forest Acres
Income
Unemployment %
Urban Pop %
Minority Pop %
Family Size

Capital
Largest City
  Pop LC
  Jan High Temp
  Jan Low Temp
  July High Temp
  July Low Temp
  Elevation
  Rainfall

Manufactured Product
Agricultural Product
Mining Product

Bloom Level 4—Analysis
To become skillful in analyzing data, students need lots of practice with a variety of data in a variety of formats. The lesson on the following pages includes experience with seven different sets of data: five sample file transparencies and two worksheets. Give your class experience with some of these lists—or others that fit with topics in the curriculum or current news events. A worthwhile way to practice data analysis is to fill 10-minute gaps in the day analyzing data charts from textbooks, almanacs, reference books, newspapers, magazines, journals, and so forth. Many of these practice sessions can be the spontaneous seizing of a "teachable moment" when a student brings an interesting list or chart from a newspaper, magazine article, or reference book to the attention of the class.

> **Note**: A "*one, true* analysis" of real-world data seldom exists. In fact, professional scientists and social scientists often disagree on interpretation. So there is no need for every student in a class to agree in their analyses of data.

Some questions the teacher can ask to help students understand and draw meaning from data include:

- What might the title of this data file be?
- What does each record represent?
- Name a field. What is the entry in that field? What range of entries would you expect to find?
- In order to be complete, how many records might this file contain?
- What connections do you see between fields?
- Can you develop hypotheses to explain these connections?
- How could a file like this be useful?
- What would be some difficulties building a file like this?
- What other information would be helpful?

There are several techniques to help students learn to analyze data. Using one or more of the following techniques and devices can give students a starting place when confronted with a list of data and little or no idea what it means. Lesson 10 contains more detailed steps for demonstrating each technique.

I. DIVIDE AND CHECK

One way to make long lists of data easier to analyze is called divide and check, in which the top of a data list is compared to the bottom to search for patterns and relationships.

As an example of divide and check, use the MOUNTAINS transparency from Lesson 7 (page 77) that has its middle section already removed. Ask the class to generate a hypothesis about the connection between continent and height. Have them test the hypothesis by placing checks beside the name of each mountain that meets some criteria set up by the class. For example, if the hypothesis is "The highest mountains are in Asia," checks by all records with "Asia" in the "Continents" field will give a good picture of the accuracy of the hypothesis.

Use the LITERACY transparency (page 89) in a similar manner. For example, you might check the names of countries that have incomes over $10,000 to see if they all have high literacy rates.

Divide and Check seems to work so well that many students will decide it is the way they will do all of their analyses. But it is not a good technique for all data. You may want to show them a case in point: the two AMERICAN LEAGUE BATTING CHAMPS transparencies (pages 101-102), which show an example of a file on which Divide and Check does not work as well.

II. SUBSTITUTE LABELS FOR NUMBERS

Another way to make data clearer to students is to assign and label numerical data as high, medium, or low. Groupings of records with high or low values in one field may be easier for students to spot than groups of seemingly unrelated numbers. Lists of numbers can be pretty numbing for novice (and even experienced) databasers to look at.

Instead of listing per capita income, for example, you could designate states with incomes over $17,000 as high, $14,000-17,000 as medium and below $14,000 as low. A cluster of states with "high" in the income field might be easier for students to analyze than a sequence of numbers like $17,456, $20,348, $18,008, $17,500.

III. RECOGNIZE THERE MAY BE NO RELATIONSHIP

Often there are *no* meaningful connections to be found in a given list of data. It is important for students to know this. This is true of the EARLY SPACE FLIGHT SAMPLE FILE (page 103), for example. We could stretch the data on this transparency to conclude things like: U.S. flights are longer or, perhaps, Russians were always first (first flight, first long flight, first double astronaut flight). But both of these conclusions could be wrong. If we were to look closely at the data we would see that the connections are too flimsy to draw those conclusions—there are too many records that don't fit.

IV. RECOGNIZE AND AVOID WARPING OF STATISTICS

Almost any set of statistics can be stretched and twisted to fit a preconceived interpretation. For example a recent *Newsweek* article about a halfway house for female ex-convicts contained the following statement to show how effective the program is:

> "Nearly half the women who go to prison wind up going back. But nearly two-thirds of the women who leave (the half-way house) stay clear of trouble."

The halfway house mentioned, may be a terrific program but careful reading of the above sentence shows it to be almost meaningless. For example, if the "nearly half" who go back to prison without the halfway house was 42%, then about 58% stay out (100% - 42% = 58%). Isn't 58% "nearly two-thirds," the same percentage who stay out because they used the halfway house?

Examining dubious advertising claims is one way of giving students practice in recognizing when statistics are misused. With the increased use (and potential misuse) of statistics in all facets of the information age (business, politics, medicine, etc.), such examinations are highly recommended.

V. DEBRIEFING

The keys to developing good analytical skills in students are (1) practice, (2) variety, and (3) debriefing. Debriefing can be done with a whole class, small group, partnerships, or individuals and consists mainly of asking questions to be sure data was not misinterpreted and that important connections were not missed. A list of debriefing questions is in the Introduction on pages 5-6. By showing students how interesting and meaningful you see their findings, debriefing is also a strong motivator. If you conscientiously debrief students as you give them more practice, you will find it gratifying to see their skills grow as your students gain experience interpreting data and discussing their interpretations with their classmates.

LESSON 10 Data Analysis Practice

OBJECTIVE

Students will practice analyzing data in sample files.

COMPUTER(S) NEEDED FOR LESSON

None

MATERIALS REQUIRED

1. Overhead projector.
2. Transparencies of:

   DRIVERS SAMPLE FILE (page 100)
   MOUNTAINS SAMPLE FILE (can be reused from Lesson 7).
   LITERACY SAMPLE FILE (page 89 in Lesson 8).
   AMERICAN LEAGUE BATTING CHAMPS SAMPLE FILE 1 (page 101)
   AMERICAN LEAGUE BATTING CHAMPS SAMPLE FILE 2 (page 102)
   EARLY SPACE FLIGHT SAMPLE FILE (page 103)
   ANALYSIS DATA (page 104)
   SCATTER GRAPH (page 106)

3. Duplicate copies for each student:

   ANALYSIS DATA and ANALYSIS WORKSHEET
   (page 104-105) back to back or stapled together

   SCATTER GRAPH and AREA AND POPULATION OF THE STATES
   (pages 106-107) back-to-back or stapled together

PRESENTATION

1. *Instruction:* Place the DRIVERS SAMPLE FILE transparency on the overhead projector, covering the bottom half. "Let's practice analyzing some data. This transparency shows how many traffic deaths there are for different aged drivers." Discussion questions:

   - What order are these records in?
   - Is this a good order for analyzing the problem?

   Uncover the bottom half of the transparency.

   - What order are the records in on this report?
   - Is this a better order for analysis? (Perhaps for some people. The first way might be better for others).
   - Can any conclusions be drawn from this data?

- Can you formulate some hypotheses to explain why ages 20-24, 15-19 and 75-99 have the most traffic deaths?
- Can you formulate some hypotheses to explain why ages 50-54, 65-69 and 55-59 have the least traffic deaths?

2. Place the MOUNTAINS SAMPLE FILE transparency on the overhead projector. "This is a report we've seen before. The top section of the report shows the 15 highest mountains, while the bottom section shows 15 of the lower mountains. Notice that the middle section is not shown. One method of analyzing data is called *divide and check*. It's steps:

    a. Formulate a hypothesis about the data.
    b. Arrange the data in a meaningful way.
    c. Plan and print a report.
    d. Divide the list into three sections: high, middle, and low. (On a very long list, the bulk of the records should be in the middle group.)
    e. Place checkmarks beside each record in the high and low groups that fits your hypothesis.
    f. Analyze by looking to see if most of the checkmarks fall in one section or the other.

    "If our hypothesis is 'The highest mountains are in Asia,' we can use divide and check on the MOUNTAINS SAMPLE FILE right away because it already has been divided into sections and the middle section has been removed. Putting checkmarks by all records with 'Asia' in the 'Continents' field will give a good picture of the accuracy of the hypothesis." Have a student place checkmarks by each *Asia* record to illustrate.

3. Place the LITERACY SAMPLE FILE transparency on the overhead projector. Have the students formulate a hypothesis for this file and use the divide-and-check technique to analyze the data.

4. Use the following steps to illustrate that divide and check doesn't work for all data:

    - Place the AMERICAN LEAGUE BATTING CHAMPS SAMPLE FILE 1 transparency on the overhead projector. It shows the earliest and latest 8 A.L. batting champions.
    - "Let's look at a baseball file. In using this batting champs file, we might come up with a hypothesis that batting averages were higher in the 'old days'."
    - "Let's arbitrarily say that .360 is a high batting average."
    - "As you can see on the transparency, there is no strong relationship between year and averages of .360 and higher when you are just looking at the top and bottom sections of the list."
    - Show the AMERICAN LEAGUE BATTING CHAMPS 2 transparency. Guide students to see that showing more data indicates a solid connection.
    - Discuss some possible reasons why divide and check doesn't work with this file (aberrations that might increase batting averages temporarily include: more lively balls or bats, rule changes, presence of several exceptional stars, weak pitching, league expansion watering down pitching talent, etc.).

5. Place the EARLY SPACE FLIGHT SAMPLE FILE transparency on the overhead projector covering the bottom half. Lead a class discussion with questions like:

    - What order are these records in?
    - What do you see in the "Craft" field? What do you see in the "Country" field?

Uncover the bottom half.

- What order are the records in on this report?
- Is there any connection between hours and year?
- Is there any connection between hours and country?
- Do we have any evidence strong enough to draw conclusions? (*No*).

Discuss the point: Many reports will be inconclusive. You may not be able to draw any firm conclusions from a given list of data.

6. Place the ANALYSIS DATA transparency on the overhead projector. Be sure students understand capital punishment and each of the fields on the report (area, density, population of the largest city, region, income in $1,000's, unemployment percentage, minority percentage). Explain that there may very well be *no* conclusions to draw about what kinds of states have capital punishment and what kinds don't. "Even so, each of you will be required on this worksheet to come up with a hypothesis to try to connect one of the numerical fields to whether or not a state has capital punishment. (For example: 'A state with a high population density is more likely to have capital punishment than a state with a low population density.') You will also be asked to decide which *regions* are most likely to have capital punishment and to speculate why." Answer questions and assign the worksheet.

7. If you want to give your students practice analyzing graphs, place the SCATTER GRAPH transparency on the overhead projector. "Each of these dots represents a state. States with dots far to the right are large in area, high dots represent states with large populations. Rhode Island is small and has a low population; where will its dot be?" (*Lower left*). "The assignment is to identify the states represented by some of the dots on the worksheet. AREA AND POPULATION OF THE STATES has all the information you will need to do the assignment." Answer questions and assign the worksheet. (See Appendix D, page *, for answers.)

8. *Follow-up activity*: Correct ANALYSIS and SCATTER GRAPH worksheets in class and discuss.

Age	*Fatals per 100,000*
15-19	78
20-24	82
25-29	51
30-34	46
35-39	33
40-44	37
45-49	32
50-54	25
55-59	27
60-64	31
65-69	27
70-74	30
75-99	62

Age	*Fatals per 100,000*
20-24	82
15-19	78
75-99	62
25-29	51
30-34	46
40-44	37
35-39	33
45-49	32
60-64	31
70-74	30
55-59	27
65-69	27
50-54	25

(Source: *The Book of Lists #2*, 1980)

AMERICAN LEAGUE BATTING CHAMPS Sample File 1

Year	*Name*	*Average*
1901	Lajoie	.422
1902	Delahanty	.376
1903	Lajoie	.355
1904	Lajoie	.381
1905	Flick	.306
1906	Stone	.358
1907	Cobb	.350
1908	Cobb	.324

Year	*Name*	*Average*
1980	Brett	.390
1981	Lansford	.336
1982	Wilson	.332
1983	Boggs	.361
1984	Mattingly	.343
1985	Boggs	.368
1986	Boggs	.357
1987	Boggs	.363

(Source: *Information Please Almanac*, 1988)

AMERICAN LEAGUE BATTING CHAMPS Sample File 2

Year	*Name*	*Average*
1901	Lajoie	.422
1902	Delahanty	.376
1903	Lajoie	.355
1904	Lajoie	.381
1905	Flick	.306
1906	Stone	.358
1907	Cobb	.350
1908	Cobb	.324
1909	Cobb	.377
1910	Cobb	.385
1911	Cobb	.420
1912	Cobb	.410
1913	Cobb	.390
1914	Cobb	.368
1915	Cobb	.369
1916	Speaker	.386
1917	Cobb	.383
1918	Cobb	.382
1919	Cobb	.384
1920	Sisler	.407
*		
1968	Yastrzemski	.301
1969	Carew	.332
1970	Johnson	.329
1971	Olivia	.337
1972	Carew	.318
1973	Carew	.350
1974	Carew	.364
1975	Carew	.359
1976	Brett	.333
1977	Carew	.388
1978	Carew	.333
1979	Lynn	.333
1980	Brett	.390
1981	Lansford	.336
1982	Wilson	.332
1983	Boggs	.361
1984	Mattingly	.343
1985	Boggs	.368
1986	Boggs	.357
1987	Boggs	.363

(Source: *Information Please Almanac*, 1988)

EARLY SPACE FLIGHT

Sample File

Craft	*Country*	*Year*	*Astronauts*	*Hours*
Vostok 1	USSR	1961	Gagarin	2
Mercury III	US	1961	Shepard	0.3
Vostok 2	USSR	1961	Titov	25
Mercury VI	USA	1962	Glenn	5
Mercury IX	USA	1963	Cooper	34
Vostok 6	USSR	1963	Tereshkova	71
Voskhod 1	USSR	1964	Komarov, Feoktistov	24
Vaskhod 2	USSR	1965	Leonov, Belyayev	26
Gemini III	USA	1965	Grissom, Young	4
Gemini IV	USA	1965	McDivitt, White	98
Apollo 7	USA	1968	Schirra, Eisele	260
Soyuz 3	USSR	1968	Bergeovoi	95
Apollo 8	USA	1968	Borman, Lovell, A	147
Apollo 9	USA	1969	McDivitt, Scott	241
Apollo 10	USA	1969	Stafford, Cernan	192

Craft	*Country*	*Year*	*Astronauts*	*Hours*
Apollo 7	USA	1968	Schirra, Eisele,	260
Apollo 9	USA	1969	McDivitt, Scott,	241
Apollo 11	USA	1969	Armstrong, Aldrin	195
Apollo 10	USA	1969	Stafford, Cernan,	192
Apollo 8	USA	1968	Borman, Lovell, A	147
Gemini IV	USA	1965	McDivitt, White	98
Soyuz 3	USSR	1968	Bergeovoi	95
Vostok 6	USSR	1963	Tereshkova	71
Mercury IX	USA	1963	Cooper	34
Vaskhod 2	USSR	1965	Leonov, Belyayev	26
Vostok 2	USSR	1961	Titov	25
Voskhod 1	USSR	1964	Komarov, Feoktistov	24
Mercury VI	USA	1962	Glenn	5
Gemini III	USA	1965	Grissom, Young	5
Vostok 1	USSR	1961	Gagarin	2

(Source: *Information Please Almanac*, 1988)

ANALYSIS DATA

Name(s) ____

TEN STATES THAT HAVE CAPITAL PUNISHMENT

State	*Area*	*Density*	*Pop LC*	*Region*	*Income*	*Unemp*	*Minority*
ALABAMA	52	79	248	SOUTH	10.0	11.1	26
ARIZONA	114	27	790	SW	11.6	5.0	18
ARKANSAS	53	45	158	SOUTH	9.7	8.9	34
CALIFORNIA	159	164	2967	WEST	14.3	7.8	24
COLORADO	104	31	492	ROCKIES	13.7	5.6	11
CONNECTICUT	5	649	143	NEW ENG	16.4	4.6	10
DELAWARE	2	309	70	SOUTH	13.5	6.2	18
FLORIDA	59	203	571	SOUTH	12.6	6.3	16
GEORGIA	59	101	425	SOUTH	11.4	6.0	28
IDAHO	84	12	102	ROCKIES	10.2	7.2	4

TEN STATES THAT DO NOT HAVE CAPTIAL PUNISHMENT

State	*Area*	*Density*	*Pop LC*	*Region*	*Income*	*Unemp*	*Minority*
ALASKA	586	1	227	WEST	17.2	10.0	?
HAWAII	6	162	365	WEST	12.8	5.6	67
IOWA	56	52	191	MIDWEST	12.1	7.0	3
KANSAS	82	30	280	MIDWEST	13.3	5.2	8
MAINE	33	37	62	NEW ENG	10.7	6.1	2
MASSACHUSETTS	8	741	563	NEW ENG	14.6	4.8	7
MICHIGAN	58	160	1203	MIDWEST	12.5	11.2	15
MINNESOTA	84	53	371	MIDWEST	13.2	6.3	3
NEW YORK	50	371	7164	MID ATL	14.1	7.2	20
NORTH DAKOTA	71	10	61	MIDWEST	12.5	5.1	4

(Source: *World Almanac and Book of Facts*, 1987)

ANALYSIS WORKSHEET

1. Your Numerical Hypothesis:

States that (have, do not have) __________ capital punishment have

(high, low) ________ numbers in the ________field.

2. Your Regional Hypothesis:

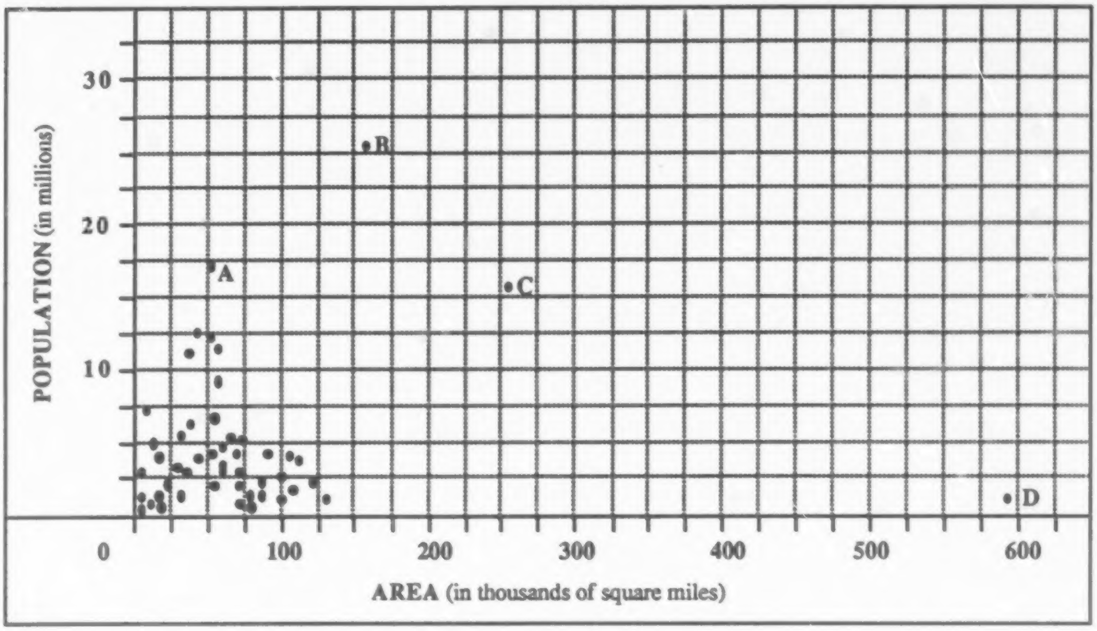
States in the ________region (have, do not have) __________ capital punishment.

If this hypothesis were true, what might explain why?

Notice which regions do and do not have capital punishment. Tell why you think different regions have different laws on capital punishment.

SCATTER GRAPH

Name ____



1. What state is represented by dot A? ______________________________

2. What state is represented by dot B? ______________________________

3. What state is represented by dot C? ______________________________

4. What state is represented by dot D? ______________________________

5. Put an E beside Oregon's dot.

6. Choose two other dots and label them F and G.

7. What state is represented by dot F? ______________________________

8. What state is represented by dot G? ______________________________

AREA AND POPULATION OF US STATES

State	*Area*	*Pop*
ALASKA	586	0.5
TEXAS	267	16.0
CALIFORNIA	159	25.6
MONTANA	147	0.8
NEW MEXICO	122	1.4
ARIZONA	114	3.1
NEVADA	111	0.9
COLORADO	104	3.2
WYOMING	98	0.5
OREGON	97	2.7
UTAH	85	1.7
IDAHO	84	1.0
MINNESOTA	84	4.2
KANSAS	82	2.4
NEBRASKA	77	1.6
SOUTH DAKOTA	77	0.7
NORTH DAKOTA	71	0.7
MISSOURI	70	5.0
OKLAHOMA	70	3.3
WASHINGTON	68	4.3
FLORIDA	59	11.0
GEORGIA	59	5.8
MICHIGAN	58	9.1
ILLINOIS	56	11.5
IOWA	56	2.9
WISCONSIN	56	4.8
ARKANSAS	53	2.4
NORTH CAROLINA	53	6.2
ALABAMA	52	4.0
NEW YORK	50	17.7
LOUISIANA	49	4.5
MISSISSIPPI	48	2.6
PENNSYLVANIA	45	11.9
TENNESSEE	42	4.7
OHIO	41	10.8
VIRGINIA	41	5.6
KENTUCKY	40	3.7
INDIANA	36	5.5
MAINE	33	1.2
SOUTH CAROLINA	31	3.3
WEST VIRGINIA	24	2.0
MARYLAND	11	4.3
VERMONT	10	0.5
NEW HAMPSHIRE	9	1.0
MASSACHUSETTS	8	5.8
NEW JERSEY	8	7.5
HAWAII	6	1.0
CONNECTICUT	5	3.2
DELAWARE	2	0.6
RHODE ISLAND	1	0.9

(Source: *World Almanac and Book of Facts*, 1987)

OVERVIEW OF LESSON 11 Synthesis and Evaluation

Bloom Levels 5 and 6

Synthesis and Evaluation, the highest level thinking skills in Bloom's taxonomy, are not often taught because, frankly, they are not very easy to teach. This lesson draws on research in teaching strategies to help make teaching of synthesis and evaluation more manageable. Please bear with me as I give a little background information. First, to define the skills you are about to teach:

Synthesis	Synthesis involves "putting parts together to form a new whole; creating new products, plans, communications or relationships" (McAlpine, 1987). Objectives that require synthesis include the ability to combine, compile, create, design, develop, organize, rearrange, reorganize, or revise (Chamberlain, 1986).
Evaluation	When students put their own views, ideas, and judgments into play, they are *evaluating*. What do students believe regarding various issues? What is the value of the information? Learning activities in which students assess, compare, conclude, contrast, judge, or weigh meet evaluation-level objectives (Chamberlain, 1986).

When students synthesize and evaluate they pull together what they have learned; they attempt to bring the "big picture" into focus. The difference between synthesis and evaluation is that while synthesis involves somewhat *objective* organization of thoughts about the topic, evaluation is more *subjective*. Evaluation involves seeking the informed opinions of the students. Together, synthesis and evaluation—the skills that are the most difficult to teach and learn—make up the top of Bloom's thinking skills hierarchy.

Describing various models for teaching higher order thinking in *Models of Teaching*, Joyce and Weil (1986) explain:

> "Probably nothing has been more consistently pursued yet remained more elusive than has the teaching of (higher order) thinking. From the earliest days of educational writing, philosophers, social reformers, and educators have tried to improve the ways humans process information and solve problems. Thus there are many models for teaching thinking" (p. 42).

One of the teaching models described by Joyce and Weil, Hilda Taba's *Inductive Thinking*, is the basis for this lesson. Inductive thinking is a perfect method for teaching synthesis and evaluation with databases for two reasons:

1. Inductive thinking is designed to teach higher order thinking skills.

2. Both databases and inductive thinking rely on *data* as their raw material.

Taba's model consists of three steps: 1. concept formation, 2. interpretation of data, and 3. application of principles.

1. **Concept Formation**. The teacher leads a "brainstorming" session in which the class responds to questions like:

   "What do you know about . . . ?"
   "What did you see in . . .?"

A recorder (often the teacher) writes the responses on a chalkboard, butcher paper, or an overhead transparency. Ideas are usually accepted without comment or discussion— positive or negative.

When brainstorming is complete, the class then organizes ideas into groups and labels the groups.

   "What belongs together? Why?"
   "What should we call this group? Why?"

The Concept Formation strategy requires students to take information they have learned about a topic under study and organize it in a new way. In short they practice *synthesis*.

2. **Interpretation of Data**. Students use the data they have organized to judge the importance of the various aspects of the topic, explore relationships, and make inferences (*synthesis* and *evaluation* skills).

   "Which of the groups are most important?"
   "Why are they the important ones?"
   "Why is *this* data more important than *that* data?"
   "What explains the apparent connection between these two aspects?"
   "What does it mean?"

3. **Application of Principles**. Answering questions at this level involves evaluation, increased productive and creative thinking, and draws students beyond the data.

   "What would happen if . . .?"
   "Why do you think this would happen?"
   "What would it take for this to be generally or probably true?" (Taba, 1967, page 109).

Used with databases, inductive thinking does not rely on data that happens to be in the collective memory of the class and teacher. The database and the skills learned in earlier lessons give students ready access to the data and the ability to put it into whatever form best meets their needs.

Thus, in good hands, the inductive thinking model in combination with databases has obvious potential for promoting synthesis and evaluation. But for this potential to be realized, of course, there is a need for solid preparation and teaching. The inductive thinking model will be most effective if the questions used in discussions and assignments are carefully prepared.

Such careful preparation produces questions that will be:

- In a sequence that makes sense.
- Designed to focus on the thinking skill(s) being taught.
- Directed toward the aspects of the content that the teacher deems important.
- Open-ended enough to allow creative thought.
- Interesting and worth the time and effort involved in high level thought processes.

The Maryland State Department of Education has produced an excellent list of question templates to guide the creation of such questions (McTighe and Lyman, 1988, page 21):

SYNTHESIS

"What would you predict/infer from _______?"

"What ideas can you add to ________?"

"How would you create/design a new _________?"

"What might happen if you combined _________ with ___________?"

"What solutions would you suggest for _____________?"

EVALUATION

"Do you agree ______________?"

"What do you think about _________________?"

"What is the most important ___________________?"

"Prioritize_________."

"How would you decide about ________________?"

"What criteria would you use to assess ________________?"

The teacher does not always need to be the one asking the questions: Rather than asking the questions themselves, teachers in one Maryland district operate under this rule: "Don't tell what you can ask. Don't ask what the students should be asking." (Worsham, 1988.)

The Maryland State Department of Education has also compiled a set of discussion strategies designed to draw higher order thought from students (McTighe and Lyman, 1988, page 21):

- Provide at least three seconds of thinking time after a question and after a response.
- Allow individual thinking time or discussion with a partner before opening the class discussion.
- Ask follow-ups. "Why?" "Do you agree?" "Can you elaborate?" "Tell me more." "Can you give an example?"
- Withhold judgment. Respond to student answers in a non-evaluative fashion.
- Ask the class to summarize the point a student has made.
- Survey opinions. "How many agree with the author's point of view?"
- Allow students to call on other students for responses.
- Require students to defend their reasoning against different points of view.
- Ask students to "unpack their thinking." "Describe how you arrived at your answer. Think aloud."
- Call on students randomly. Not just those with raised hands.
- Let students develop their own questions.

The sample questions on the THINK ABOUT IT Problem Sheets (pages 119-120) are written using the above questioning and discussion strategies. Use of the inductive thinking model with these or other carefully prepared questions is one way to generate discussions and assignments that foster synthesis and evaluation-level thinking in students.

OBJECTIVE

Students will synthesize ideas and concepts regarding states of the U.S. and evaluate the unit in class discussion and a written assignment.

COMPUTER(S) NEEDED FOR LESSON

Possibly one or more for reference.

MATERIALS REQUIRED

1. Overhead projector.
2. Duplicate THINK ABOUT IT Problem Sheet 1 and THINK ABOUT IT Problem Sheet 2 (pages 119-120) back-to-back for each student.
3. Duplicate THINK ABOUT IT Assignment Sheet 1 and THINK ABOUT IT Assignment Sheet 2 (pages 121-122) back-to-back for each student.
4. Transparencies of:

   URBAN DENSITY 1 and 2 (pages 117-118)
   THINK ABOUT IT Problem Sheets 1 and 2 (pages 119-120)
   THINK ABOUT IT Assignment Sheets 1 and 2 (pages 121-122)

PRESENTATION

1. *Instruction*: "You have learned a great deal about the states, about how to organize and analyze data, and about how to use a computer to help. Today your assignment will be to answer some questions that will require you to really **think** about what you've learned."
2. "Let me show you what I mean." Place URBAN DENSITY 1 transparency on the overhead.
3. "We will be discussing a set of questions about the problems of crowded cities."

   Note: Each of these steps may require quite a bit of discussion time. It may be necessary for this lesson to spill over into another day.

   Read the problem and the brainstorming question aloud. ("What could be done to improve living conditions in high-density urban areas?" and "What are some of the problems of living in crowded cities?")
4. If the students have not brainstormed before, explain the process. Ideas, without long explanations, are accepted without comment or judgment and are recorded by the teacher. Later they will be organized and refined.

5. "Tell me what you think might be some of the problems of crowded cities."

6. Paraphrase and write the student's ideas under number 1a on the transparency.

    - **Examples: apartments, traffic jams, high cost of living, smog, tenements, crime, parking problems, gangs, drugs, neighbors too close, neighbors above and below and beside you, high unemployment, etc.**

7. Next, have students sort the items they have brainstormed into groups with something in common, and when this is done, assign labels to the groups. Some questions that might help students do this: "Do any of the items on our list belong together?" "How many groups do we need in order to include all the items?" "Should any of the items be combined or omitted?" "What is a good name for this group?"

    - **For example, one group might be called "safety" and include: crime, gangs, and drugs. Another group could be "quality of life" with items like: noise, closeness of neighbors, and alienation.**

8. Read question number 2 from URBAN DENSITY 1. ("What might be done to solve one group of problems of living in crowded cities?") Have the class choose (by consensus or vote) one of the groups of problems on which to work.

9. Brainstorm ideas for solutions and write them under number 2.

    - **Examples of solutions to the "safety" problem: put deadbolts and grates on the windows, everybody could have a gun, hire the unemployed to build new places to live, a neighborhood-watch program.**

10. After discussion of potential solutions, move to the third question (on URBAN DENSITY 2): "Develop a plan based on the most promising solution you thought up in number 2."

11. First the class must select the "most promising solution" by consensus or, if necessary, by vote. Then, one or more plans for implementing the solution must be agreed to and written under number 3.

    - **Example: We plan to begin a neighborhood association to hire and train the unemployed to build new apartment buildings. The people who build the apartments will be among those who will live in them.**

12. Read the fourth question from URBAN DENSITY 2 ("What problems can you predict you might have with your plan?")

13. Record student responses under number 4 on the transparency.

    - **Examples: It would cost a lot of money to build new apartments and train the unemployed in construction. Unemployed drug addicts would have to learn to live without drugs before they could work for us. Would we have to tear something else down to build our apartments?**

14. After discussion of the problems, move to the fifth question on URBAN DENSITY 2: "Who might be hurt by your plan? How would it hurt them?"

15. Again, record student responses on the transparency.

- **For Example: Taxpayers would need to come up with a lot of money for the project. People in neighborhoods where nothing is being done might be jealous.**

16. Finally, read the last question from URBAN DENSITY 2 ("If your plan had been used for ten years, how could you test to see if it had worked?") and record the answers under number 6.

    - **Examples: "The most important thing for me would be to see if the people were happier. I would just go around and ask them if they liked the apartments and whether life was better for them." "The police could tell whether the crime rate and drug use had dropped and if traffic and smog were any better." "One other thing I would look at would be to see if any other apartments like this had been built."**

17. Class discussion of the urban density problem: "How did we begin thinking about the problem?" (*Brainstorming*.)

18. Discuss the fact that there is no one right answer to these types of questions. The *no-one-right-answer* lecture that could go something like: "Maybe you don't know everything that I know about high-density living. And maybe you know some things that I don't. We all have a different knowledge base. Some of it comes from our work in this class, but since each of you invented your own hypotheses to test, you all learned different things. Some of our knowledge comes from our experiences outside of class, and all of us have different past experiences. So your answers to these questions would be different from mine and different from everyone else's. That's fine because there is no *one* correct answer. In fact, there may not be a correct answer at all. In fact, if there were a simple answer, might not the problem have already been solved? On your assignment, I will not be looking for the answer as much as the way you think about the problem."

19. Discuss the process and answer student's questions.

20. Place the THINK ABOUT IT *Problem Sheet 1* transparency on the overhead. "Your assignment today will be to choose one of these sets of questions to think about. You will write your thinking on paper, just as we did on the URBAN DENSITY transparencies, so I can see how you go about working on the problem." Read the questions on THINK ABOUT IT *Problem Sheet 1* aloud, or ask the students to read them silently, then switch to THINK ABOUT IT Problem Sheet 2 and do the same. When they are finished, ask them to think over the questions and to prioritize them according to those that interest them most.

    Note: This assignment is a good opportunity to use cooperative learning.

21. If the students are not yet ready to work out a question set individually or in teams, you may want to do one of the question sets as a whole-class practice session. If so, have the students agree on one of the questions that few students gave a high priority. Use blank transparencies to record the way the students in the class approach the problem. Be sure they start by brainstorming what they know about the topic.

22. Discuss the process and answer student questions.

23. Pass out the THINK ABOUT IT Problem Sheet and the THINK ABOUT IT Assignment Sheet.

24. Ask the students to agree on a final choice of which set of questions to use. Explain that they will do much of their thinking on their papers. Ask students to head their papers by copying the main question from their set and explain that they should begin each section by writing the particular question they are working on. The assignment can be done in class or can be carried over as homework and/or to another day.

25. Monitor students' progress as they work. Help students clarify their thinking, but do not give them answers or information. Have them refer back to their brainstorming sections or to the States data file for ideas when they are stuck on a particular problem.

    Follow-up activity: Individual or team debriefing with the emphasis on the positive. Share summaries with the class.

URBAN DENSITY 1

Name(s) ______________________________

1. Write the problem in this space.

   What could be done to improve living conditions in high density urban areas?

   1a. Write your *brainstorming* problem and list in this space.

   What are some of the problems of living in crowded cities?

   1b. Put your ideas from above in groups in the space below. Then label the groups.

2. What might be done to solve one group of problems of living in crowded cities?

URBAN DENSITY 2

3. Develop a plan based on the most promising solution you thought up in number 2.

4. What problems can you predict you might have with your plan?

5. Who might be hurt by your plan? How would it hurt them?

6. If your plan had been used for 10 years, how would you test to see if it had worked?

THINK ABOUT IT Problem Sheet 1

QUESTION SET 1

In the history of the U.S., many states have been split into two or more parts. Oregon and Washington were once one; so were Virginia and West Virginia. They usually divided because of some difference between the parts. Describe what it would be like if your state were to split into two parts.

1. Brainstorming: What might be the differences that would divide the state?
2. Where do you think the dividing line would be? Why?
3. What would be some advantages, disadvantages, and problems each of the parts would have as independent states?
4. Make up names for the new states. Explain why you chose them.
5. Design an argument for or against splitting the state.
6. If you were President of the U.S., what would be your opinion about splitting the state?

QUESTION SET 2

Currently the southern, southwestern and western parts of the U.S. are the fastest growing regions. Why and when might that change?

1. Brainstorming: What is different about states in these regions and the states in the rest of the U.S.?
2. If you lived in New York, why might you want to move to Arizona?
3. Predict some things that might happen to a fast-growing state that would make it less desirable to move to.
4. Predict when a state like Arizona might stop growing faster than a state like Wisconsin: one year, five years, 10 years, 20 years, never? Explain your prediction.
5. What would be the most important things to you in choosing a place to move?
6. Would you like to move to a different region? If so, when? Where? Why or why not?

QUESTION SET 3

What region of the U.S. is the "most important"?

1. Brainstorming: Name strengths and weaknesses of each region.
2. Prioritize the characteristics listed in your list of strengths and weaknesses according to how they rank in making a region "important."
3. Use your answers to numbers 1 and 2 to decide which two regions you think are the most important. Explain your choice.
4. Compare and contrast your top two regions.
5. Choose the one you think is *most* important. Explain your choice.
6. What priorities would have to change to move your number two region to the top?

QUESTION SET 4

Will the U.S. ever elect a Black or other minority person as President?

1. Brainstorming: What factors might keep us from having a minority President?
2. What might happen to change those factors?
3. Describe some of the personal characteristics a minority person would need to have to be elected President.
4. Design a campaign for a minority candidate. What would be the issues to stress?
5. Predict what regions and segments of the country might support a minority candidate most strongly. Explain.
6. Do you think we will have a minority President in your lifetime? Explain your answer.

QUESTION SET 5

What could increase Mississippi's average annual income?

1. Brainstorming: Why do Mississippians earn less on average than other Americans?
2. Compare and contrast Mississippi with a state with a high average annual income.
3. What do you think are the three most important reasons for Mississippi's low average annual income? Explain you choices.
4. What solutions would you suggest?
5. If you were Mississippi's governor, what would be the first thing you would do to solve this problem? Explain.
6. Governor, who would be helped by this action? Would it hurt anybody in your state? Anyone outside your state? Explain your answers.

QUESTION SET 6

In some of our major cities, almost half the young minority men and women do not have jobs. How can the problem of minority unemployment be solved?

1. Brainstorming: What factors keep minority youth from getting jobs?
2. Which factors are the same and which are different for white youth?
3. What are the three most important factors that keep minority youth unemployment high?

4. What solutions could you suggest?

5. If you were President of the U.S., what would be the first thing you would do to help solve the problem? Explain your answer.

6. Mr./Ms. President, predict who might oppose your idea and tell why they would.

7. When the file is complete and checked, merge files, if necessary (see *Using Microsoft Works*, page 156) and make a copy of the disk for each computer the students will be using. (See Appendix A, page 157).

8. Follow-up: When students are done entering data, congratulate the class on completing the RESEARCH FILE data file. Discuss data entry, how it went, problems, and so forth. Students may want to speculate about what it would be like to enter data for a living. Have students use the file to answer questions, test hypotheses, and do projects. REPORT (Lesson 5, page 64) and THINK ABOUT IT Assignment Sheets (Lesson 11, pages 119-120) may prove helpful to give students practice using the data file they have built.

THINK ABOUT IT	Assignment Sheet 1

Write the problem in this space.

1a. Write your *brainstorming* list in this space.

1b. Put your ideas from above in groups in the space below. Then label the groups.

2.

3.

4.

5.

6.

OVERVIEW OF LESSON 12 Extensions

Bloom Levels—All

Practice manipulating the data in the database is important. Some ways to give students practice are listed below.

1. Have students continue generating and testing hypotheses until the content of the curriculum has been covered. If there are still gaps in their knowledge of the topic, nudge groups toward making and sharing reports that fill those gaps. Vary the assignments and wean the students from the REPORT worksheet. If you are doing a project (see Lesson 15), students should now be searching for the report they want to polish for presentation.

2. Play with the data file. Give the students a different sort of contact with databases and the topic under study by playing games with the computer data file. Lesson 12a on the following pages describes a trivia game and an attribute game in which the computer acts as an answer checker.

3. Venn diagrams that require students to compare two or more records looking for attributes in common are a fun way to examine relationships between states. To compare two records, the students draw overlapping circles, one for each state. Students write each field and entry in the appropriate section of the drawing. Attributes shared by both states go in the section where the circles overlap; the others go in the non-overlapped portion of that state's circle. See Swett, 1985 for detailed instructions and worksheet ideas.

4. Discuss when it is and when it is not appropriate to use a database. Lesson 12b on the following pages is an example of a lesson in which students decide which is better for certain purposes, computer data files or paper lists.

5. Review the uses of databases. Lesson 12c includes an assignment that requires students to use an imaginary data file to describe some of the things that can be done with databases.

6. Ask students to color-code maps or graphs to illustrate distribution of certain values or attributes from the database file. In Sunburst's video *Using Databases in the Classroom* (1987), for example, students color code a U.S. map to show the population densities of the states.

LESSON 12a Class Games with the States Data File

OBJECTIVE

Students will participate in games and practice referring to the STATES data file as a source of information.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration and one or more for student use.

MATERIALS REQUIRED

1. 3 x 5 cards for each partnership.

PREPARATION BEFORE CLASS

1. Place copies of Microsoft *Works* and the STATES data disk beside each computer.

PRESENTATION

Play one or both games as follows:

1. Game 1—State Fact Game:
    a. Divide the class into two teams.
    b. Have each team make up 10 questions with factual answers that they think could be in the data files. They should write them on 3 x 5 cards.
    c. Team 1 draws one of the cards they wrote and reads it. Members of Team 2 try to answer the question.
    d. Members of Team 1 check the answer on the computer.
    e. If the answer checks out, Team 2 gets a point. If they are wrong, no points. If the answer is not in the file, subtract 1 from Team 1's score.
    f. Next Team's turn.

2. Game 2—Attribute Chains:
    a. Team 1 names a state.
    b. Team 2 names a state that has an attribute in common with Team 1's state. Check on the computer.

c. Team 1 names a state with an attribute in common with Team 2's state. Check.

d. States already named are out of play. The team that stumps the other team wins.

e. Variations: Students or individuals can try to make chains that include all the states or students must predict the attribute in common.

Sample Game

Team #	*Guess*	*Attribute in Common*
1	California	
2	Oregon	Region
1	Maine	Largest City
2	Montana	U.S. Representatives
1	N. Dakota	Year admitted
2	Pennsylvania	None. Team 1 wins.

OBJECTIVE

Students will demonstrate knowledge of advantages and limitations of databases in class discussion and with their responses on a worksheet.

COMPUTER(S) NEEDED FOR LESSON

None.

MATERIALS REQUIRED

1. Overhead projector.
2. Transparencies of:

   REJECTIONS SAMPLE FILE (page 129)
   PHONE BOOK SAMPLE FILE (page 130)

3. Duplicates of worksheet, TO DATABASE OR NOT TO DATABASE? (page 131)
4. Large sheet of butcher paper or blank chalkboard.

PRESENTATION

1. *Introductory activity*: Discuss the usefulness of the REJECTIONS and PHONE BOOK sample files. "Is it really very worthwhile to be able to sort and select in the REJECTIONS file? Would a paper list be just as good? PHONE BOOK is a data file we have all used. Is it more valuable to you as a book or a computer data file?"
2. "Let's now compare computer databases to paper ones like encyclopedias." Label half of a chalkboard or sheet of butcher paper *encyclopedia* and the other half *computer database*.
3. Ask the students to brainstorm advantages of one over the other. (Examples: an encyclopedia is less expensive than a computer, and requires little training to use; a database can arrange, search, and print out information in whatever form the user wants.) Discuss the items they generate and refine the list.
4. "Which is better, then?" (*Encyclopedias are good for some jobs, databases for others. Neither is better.*)
5. Distribute and discuss worksheet TO DATABASE OR NOT TO DATABASE? Assign as seatwork or homework.
6. Correct and discuss the worksheet, encouraging students to convince you (and each other) that their answers could also be correct.

7. Discuss some of the ways databases can be misused (for example: misuse of credit records or invasion of privacy).

8. Discuss some other ways information can be used or manipulated unethically (*computer theft, alteration of official records*).

REJECTIONS Sample File

Title	*Author*	*Year*	*Rejections*
Lorna Doone	Richard Blackmore	1869	18
Dubliners	James Joyce	1914	22
Lust for Life	Irving Stone	1934	17
And to Think I Saw It On Mulberry	Dr. Seuss	1937	23
Kon Tiki	Thor Heyerdahl	1950	20
Heaven Knows Mr. Allison	Charles Shaw	1952	32
Auntie Mame	Patrick Dennis	1955	17
Dune	Frank Herbert	1965	13
M*A*S*H	Richard Hooker	1968	21
The Peter Principle	Laurence Peter	1969	16
Jonathan Livingston Seagull	Richard Bach	1970	18

Title	*Author*	*Year*	*Rejections*
Heaven Knows Mr. Allison	Charles Shaw	1952	32
And to Think I Saw It On Mulberry	Dr. Seuss	1937	23
Dubliners	James Joyce	1914	22
M*A*S*H	Richard Hooker	1968	21
Kon Tiki	Thor Heyerdahl	1950	20
Lorna Doone	Richard Blackmore	1869	18
Jonathan Livingston Seagull	Richard Bach	1970	18
Lust for Life	Irving Stone	1934	17
Auntie Mame	Patrick Dennis	1955	17
The Peter Principle	Laurence Peter	1969	16
Dune	Frank Herbert	1965	13

(Source: *The Book of Lists #2*, 1980)

PHONE BOOK Sample File

Last Name	*First Name*	*Address*	*Phone*
Larson	Alice	123 Wilson	555-2875
Larson	Allen	4523 32nd	555-0476
Larson	B.J.	45 W. 6th	555-9070
Larson	Barbara	3678 24th	555-6777
Larson	Beth	4521 Anderson	555-5209
Larson	Billie	625 Main	555-4109
Larson	Carl	12 Adams	555-2309
Larson	Dianne	56 Soda Springs Rd	555-6324
Larson	Hedda	692 10th	555-4598
Larson	Henry	2387 30th	555-1429
Larson	James	908 McKinley	555-6700
Larson	JoAnne	3567 15th	555-1090
Larson	John	653 Wilson	555-1879
Larson	Jonathan	154 Filmore	555-5398
Larson	Opal	243 18th	555-9800
Larson	Pete	897 16th	555-1739
Larson	Phil	3678 24th	555-6777
Larson	R	86 Cedar	555-7205
Larson	Robert	90 N. Mason	555-1156
Larson	Roberta	90 N. Mason	555-0066
Larson	Seth	1427 Oak	555-2000
Larson	Vaughn	687 12th	555-5755
Larson	Wanda	3251 Fir	555-1980
Larson	William	567 Grant	555-5476
Larson	William	735 Wilson	555-1276

Selection: Address contains WILSON

Last Name	*First Name*	*Address*	*Phone*
Larson	Alice	123 Wilson	555-2875
Larson	John	653 Wilson	555-1879
Larson	William	735 Wilson	555-1276

TO DATABASE OR NOT TO DATABASE?

NAME(S) ____

Would it be best to use a PAPER DATA BASE (encyclopedia, phone book, etc.) or a COMPUTER DATA BASE to do the following jobs? (Write a P on the line for paper or a C for computer).

_____ Find the capital of Indonesia.

_____ What is Wild Bill Hickock's birthday?

_____ List the top 100 home run hitters in baseball history.

_____ Name the countries that export beef.

_____ Where is it 70 degrees in January?

_____ What year did Balboa land in California?

_____ What do Minnesota and Alabama have in common?

Name three things that would be easier to do with a phone book than a computer database of phone numbers and addresses.

1.

2.

3.

Name three things that would be easier to do with the computer database.

1.

2.

3.

LESSON 12c — Uses of Databases

OBJECTIVE

Students will demonstrate knowledge of the uses of databases in class discussion and responses on worksheet.

COMPUTER(S) NEEDED FOR LESSON

None.

MATERIALS REQUIRED

1. Overhead projector.
2. Duplicates of worksheet, WHAT SHOULD YOU DO TO THAT BASEBALL FILE? (page 134)
3. Make a transparency of WHAT SHOULD YOU DO TO THAT BASEBALL FILE? Answer Sheet. (page 135)

PRESENTATION

1. *Instruction:* Place transparency of WHAT SHOULD YOU DO TO THAT BASEBALL FILE? Answer Sheet on the overhead projector, covering everything from the answer to number 1 to the end.
2. Discuss the information you would expect to find in each field of this imaginary baseball file.
3. Discuss question number 1. Uncover sample answer and discuss. Tell the students that they will be answering this question too, and will not be allowed to use the same as those on the transparency.
4. Discuss the rest of the worksheet in the same manner as number 1.
5. Distribute worksheets and assign as seatwork or homework.
6. *Follow-up activity*: Correct and discuss worksheets in class.

WHAT SHOULD YOU DO TO THAT BASEBALL FILE?

Name(s) ____

A database file of baseball statistics might have the following fields:

PLAYER BATTING AVERAGE EXPERIENCE POSITION SALARY

1. Why might it be a good idea to UPDATE INFORMATION in the baseball file?

2. Give an example of how you might use the baseball file to SHOW RELATIONSHIPS (that is, show how two fields are related).

3. How might a group of people SHARE INFORMATION as they build the baseball file?

4. Give an example of a TREND you might find with the baseball file.

5. Give an example of a way you might REARRANGE the file, and tell why it might be useful to arrange it that way.

6. List two questions you might be able to answer with the baseball file. Guess what the answers might be.

WHAT SHOULD YOU DO TO THAT BASEBALL FILE?

Name(s) ____

A database file of baseball statistics might have the following fields:

PLAYER BATTING AVERAGE EXPERIENCE POSITION SALARY

1. Why might it be a good idea to UPDATE INFORMATION in the baseball file?

   I don't want last year's batting averages, I only want this year's.

2. Give an example of how you might use the baseball file to SHOW RELATIONSHIPS (that is, show how two fields are related).

   I want a list of all third basemen and their batting averages to see if third basemen are weak hitters.

3. How might a group of people SHARE INFORMATION as they build the baseball file?

   I will keep track of the National League while my friend keeps track of the American League. Then we will share the information.

4. Give an example of a TREND you might find with the baseball file.

   Perhaps a player with a high salary and a low batting average is having a bad year.

5. Give an example of a way you might REARRANGE the file, and tell why it might be useful to arrange it that way.

   I want a list of players in order of experience.

6. List two questions you might be able to answer with the baseball file. Guess what the answers might be.

   What is Jim Rice's salary?
   What player is paid the least?

OVERVIEW OF LESSON 13 Building a Data File—Optional

Bloom Levels—All

Building and creating data files is time consuming and not appropriate to every area of study. If you choose not to build or create data files skip Lessons 13 and 14.

After they have had experience using a ready-made data file, Beverly Hunter (1985) suggests the next step is to for students to build their own. The topic can be an extension of an earlier topic or a new one entirely. (If you change topics, be sure to put the finishing touches on the unit you are completing—see Lesson 15).

In building a data file, the teacher plans and creates a template (see Lesson 14, #5 for how to do this). Then students do the research, enter and edit the data, and use the file to answer questions, test hypotheses, and do projects.

The steps involved in having students build a data file include:

1. Locate sources of data. The school or local library will often have all you need but sometimes it is necessary to send for information. It is usually important that you have this information in hand before you design the unit and the file so you can avoid asking students to gather information it is impossible for them to find. It is also possible to have students gather original data, as in a neighborhood survey.

   Note: If students with minimal keyboarding skills will be doing the data entry, you may want to limit the number of fields with lots of text to type.

2. Design a standard Research Sheet for students to record their data. List the fields you want to include, then put them in a logical order: most important items first, related items together. Write and duplicate a standard form for students to record the results of their research. Include on the form one field for the name of the researcher and another as a *check* field for teacher comments. Microsoft *Works* allows up to 60 fields and the length of any one entry is limited to 250 characters, though not all of those will be visible on the screen.

3. Assign the research. Have the students use the research form you have developed to record the information they find. Allow ample time to complete it. Lesson 13a illustrates a research assignment on states that includes fields different from those in the file the students have been using.

   Note: Assigning more than one person or group to each record is one way of cross-checking the accuracy of the data collected. When they are done with their independent research, those with the same record can compare their data to find inconsistencies that can be rechecked.

4. When the research forms are complete, discuss the results of the students' research and help them clean up and standardize the entries on their forms. What items were impossible to find? Was any of the information ambiguous or misleading? Did we leave out any fields that might be important? Do any of the fields contain different entries that mean the same thing (like lumber and wood products)? If so, agree on conventions (conventional terms) to use. Should any numerical fields with long entries be listed in units of a thousand, a million, etc.? Work standardization until the format of entries has been agreed upon and all students have changed their forms to reflect the agreements made.

5. Peers check data. If records were assigned to more than one group or person, have those students compare data and check out areas of disagreement. If records were not double-covered, pair students up to act as "show-me" skeptics.

6. Students enter the data. Assign students to take turns entering data at the computer and saving it. Use one computer and one disk for this lesson if you wish to avoid the need to merge files later. (Merging files, however, is not difficult with Microsoft *Works*. It involves copying to the clipboard and is described in detail on page 156 of *Using Microsoft Works*). Lesson 13b illustrates one way to orchestrate data entry with a class. Those who have not finished their research should do so before being assigned computer time. Use the DATA ENTRY AND EDITING INSTRUCTIONS sheet (page 143) to assist students, if necessary.

7. Teacher checks data. Scan each form for problems. Discuss general problems with the group. Note problems with individual records in the *Check* field with comments like: "Spelling in the REGION field" or "Are you sure about Pop—Largest City?" To help you spot blank or suspect entries, you can use Open Apple-A to arrange the file by a field and then scan the records.

8. Edit the data file. Rotate students onto the computer to make changes suggested in the *check* field. Use the DATA ENTRY AND EDITING INSTRUCTIONS sheet (page 143) to assist students if necessary.

9. Use the data file. Have the students browse, sort, search, generate, and answer questions, test hypotheses, and do culminating projects and activities with the data file. Lesson 13c includes as examples several assignments for a file on Oregon counties built by my students as an extension of the States Unit. It can serve as an example of a file built with a local focus.

LESSON 13a
Optional Lesson on Building a Data File: Researching the States

OBJECTIVE

Students will research facts about assigned states in order to create an additional STATES data file.

COMPUTER(S) NEEDED FOR LESSON

None.

MATERIALS REQUIRED

1. Overhead projector.
2. Worksheets/transparencies of RESEARCH ASSIGNMENT: STATES (page 140).
3. Duplicate 50 of the RESEARCH ASSIGNMENT: STATES worksheets (page 140).
4. You may want to write the names of the states on the research worksheets you've duplicated.
5. Almanacs, encyclopedias, or library research time. Between them, *The World Almanac and Book of Facts* and *The Information Please Almanac* have all of this data.

PRESENTATION

1. *Instruction:* "To make our study of the states more complete, I need your help to gather and *enter* more information about each state." Place RESEARCH ASSIGNMENT: STATES transparency on the overhead. "These are the fields that we need to fill on new records about each state."
2. Discuss each field and answer any questions.
3. Discuss sources for this information.
4. Give research assignments to partners or individuals. Teachers could assign states, students could choose their state(s), or they could be randomly assigned by just passing out the research sheets or drawing from a hat.
5. Assist students having trouble getting started.
6. *Follow-up*: When they finish doing their research, have students discuss RESEARCH ASSIGNMENT worksheets. Was any information difficult to find? Have students give suggestions to those who had trouble finding information.

RESEARCH ASSIGNMENT: STATES

State:

Post Office Abbreviation:

State Flower:

State Bird:

State Tree:

Nickname:

County Number:

State Forests:

State Parks:

State Park Acres:

Points of Interest:

Researcher:

Teacher Check:

Fixed:

LESSON 13b Optional Lesson: Building a States Data File: Data Entry

OBJECTIVE

Students will enter research data into a data file.

COMPUTER(S) NEEDED FOR LESSON

One for demonstration and one or more for student use. If you use more than one computer, files will need to be merged.

MATERIALS REQUIRED

1. Duplicate DATA ENTRY AND EDITING INSTRUCTIONS (page 143) and place a copy beside each computer; mounting on stiff paper and/or laminating would be helpful.
2. Tagboard or butcher paper for wall chart.

PREPARATION BEFORE CLASS

1. Load Microsoft *Works* and add the RESEARCH FILE data file to the desktop. This file is a template that matches the RESEARCH ASSIGNMENT: STATES sheet from Lesson 13a.

   IMPORTANT: When entering data, use only one computer and one program/data disk unless you are willing to "merge" files (see *Using Microsoft Works*, page 156). Otherwise the data will be spread over several disks and searches and sorts will be less meaningful. When the file is complete, make multiple copies of the disk (one for each computer the students will be using).

PRESENTATION

1. *Instruction:* Define **conventional terms** for each field. (See page 138, number 4.)
2. Demonstrate (or have a student demonstrate) entering data from a RESEARCH ASSIGNMENT worksheet into the computer using the DATA ENTRY instructions.
3. Explain that the **Check** field is where you (the teacher) will put comments and suggestions about changes that need to be made. Have them leave the **Check** field blank.
4. Explain that as students make changes, they should write what they did in the **Fixed** field. Leave it blank too for now.
5. Schedule computer time for those students who have finished their research. Have the rest of the students complete their research before they are scheduled.
6. Check data from time to time and place comments in the **Check** field. Be sure students edit their entries as required.

7. When the file is complete and checked, merge files, if necessary (see *Using Microsoft Works*, page 156) and, make a copy of the disk for each computer the students will be using. (See Appendix A, page 157).

8. *Follow-up*: When they are done entering data, congratulate the class on completing the RESEARCH FILE data file. Discuss data entry, how it went, problems, etc. Students may want to speculate about what it would be like to enter data for a living. Have students use the file to answer questions, test hypotheses, and do projects. REPORT (Lesson 5, page 64) and THINK ABOUT IT (Lesson 11, pages 119-120) may prove helpful to give students practice using the data file they have built.

DATA ENTRY AND EDITING INSTRUCTIONS Microsoft *Works*

GETTING THE COMPUTER READY:

(First person or teacher only)

1. Place the RESEARCH FILES file onto the Microsoft *Works* Desktop.

ENTERING DATA:

1. If the screen displays the record of one state, select Show List from the Format menu (or press Command-L) to view the multiple record layout.
2. Highlight the name of the state for which you will be entering information. Or if your record is not in the file yet, click on the last entry.
3. Select Show List from the Format menu (or press Command-L) to view your state's record.
4. Click on (or Arrow to) the first empty field.
5. Enter the information from your RESEARCH ASSIGNMENT—STATES worksheet. Press RETURN.
6. Keep entering information until all of it is entered.
7. When you are finished entering, look over the data to make sure it is correct.
8. If there are any errors, click on the line to change.
9. Click behind the mistake and tap DELETE to erase. Type in corrections and press RETURN.
10. Correct any other mistakes.
11. Repeat the above steps for each record to enter.

WHEN YOU HAVE NO MORE DATA TO ENTER:

1. Select Save from the File menu (or press Command-S). Your work will automatically be saved.
2. Help the next student get started.

LESSON 13c
Optional Lesson Building and Using an Oregon County Data File

OBJECTIVE

Students will design a data file for Oregon counties. They do research, help create a file, formulate hypotheses, and analyze data.

COMPUTER(S) NEEDED FOR LESSON

One or more for student use. Printer required.

MATERIALS REQUIRED

1. Research materials that will provide data on Oregon. The *Oregon Bluebook* is a good source.
2. Overhead projector.
3. Duplicates of worksheets:

   RESEARCH ASSIGNMENT: OREGON COUNTIES (page 146)
   WHERE DOES OREGON STAND (page 147)
   EXPLORE: OREGON COUNTIES (page 148)
   REPORT (page 64 in Lesson 5).

4. A Microsoft *Works* data disk. (*Using Microsoft Works*, page 6).

PRESENTATION

1. *Instruction:* Explain that the goal of this lesson is to expand the study of the states by zeroing in on one of them—Oregon.
2. Assign RESEARCH ASSIGNMENT: OREGON COUNTIES.
3. Have students help create a file and take turns entering data into it.
4. Assign WHERE DOES OREGON STAND? after reviewing how to arrange files. (See Appendix D, page 162, for answers.)
5. Review selecting records and assign EXPLORE: OREGON COUNTIES. (See Appendix D, page 162, for answers.)
6. Generate a set of questions or hypotheses and have students use the database, data file and REPORT to find answers and test hypotheses.
7. Debrief each assignment.

RESEARCH ASSIGNMENT: OREGON COUNTIES

County:

County Seat:

Region:

Established:

Area:

Population:

True Cash Value:

Elevation:

Ave Jan Temp:

Ave July Temp:

Precipitation:

Industries:

Points of Interest:

Population Change:

Income:

Researcher:

Check:

Fixed:

WHERE DOES OREGON STAND?

Name(s) ____

On the line before each item below, put Oregon's rank compared to the rest of the U.S.

_____ In the alphabet. (Alabama is number 1, Wyoming is number 50. What is Oregon?)

_____ Area. (Largest is number 1).

_____ Population. (Largest is number 1).

_____ Density. (Highest is number 1).

_____ Population Change Percent. (Highest is number 1).

_____ Income. (Highest is number 1).

_____ Unemployment. (Lowest is number 1).

_____ Year admitted to the U.S. (Earliest is number 1).

_____ Population of its largest city. (Largest is number 1).

_____ Elevation. (Highest is number 1).

_____ Rainfall. (Most is number 1).

_____ July high temperature. (Highest is number 1).

_____ January low temperature. (Highest is number 1).

_____ Number of U.S. Representatives. (Most is number 1).

In which field did Oregon rank nearest number 1? ____________
Can you explain why Oregon ranks that high?

In which field did Oregon rank nearest number 50? ____________
Can you explain why Oregon ranks that low?

In which field did Oregon rank nearest number 25? ____________
Name the rank that surprised you most and tell why.

EXPLORE—OREGON COUNTIES

Use the database program and the OREGON file to answer the following questions:

1. What are the three largest counties (in area) in Oregon?

2. Where does Lane County rank in area?

3. What three counties have the largest populations?

4. Where does Lane County rank in population?

5. In what region are the three Oregon counties that were admitted first located? (Hint: Will the earliest admitted counties have the highest or lowest numbers in the "Admitted" field?)

6. Choose a field (not area or population) and list the top three counties in that field and where Lane County ranks.

7. Choose another field and list the top three counties in that field and where Lane County ranks.

8. Browse through the records and list three interesting facts or relationships that you have discovered:

OVERVIEW OF LESSON 14 Creating a Data File—Optional

Bloom Levels—All
Building and creating data files is time consuming and not appropriate to every area of study. If you choose not to build or create data files skip Lessons 13 and 14.

Beverly Hunter's (1985) third step in teaching of databases is having students design and create one of their own. The ultimate goal of introducing databases to students is to give them a tool that, when appropriate, will enable them to independently solve problems. Like a carpenter who is able to use a framing square to ease the job of building stairs, students would have access to a specialized tool that allows them to make sense of a large amount of information. Often students will have access to an already prepared data file on the topic at hand, but, at times, it might be helpful for the student to know how to create one from scratch. Lesson 14 on the following pages is an example of a way to broaden the study of the states of the U.S. by creating a Regions of North America file.

Here is a step-by-step guide to helping students learn to design and create a data file with Microsoft *Works:*

1. Decide first what each record will represent. In the STATES file, it was easy to decide that each record would represent a state, but in a file on baseball, records could be for each player, team, manager, ball park, etc. depending on the use to be made of the data file.

2. Locate sources of data. (See Overview of Lesson 13, #1, page 137.)

3. Design the data file. From the sources available, list the types of information that may be needed to do the job the data file is being designed to do. Next, organize these types of information into logical groups, groups that will become the FIELDS of the data file. Then put these fields into an order that makes sense: most important items first, related items together. Include on the form one field for the name of the researcher, another as a "check" field for teacher comments and a couple of blank fields at the bottom of the file for possible use at a later time. Microsoft *Works* allows up to 60 fields and the length of any one entry is limited to 250 characters.

4. Duplicate a research sheet, assign the research, and check the data. (See Overview of Lesson 13, #3-5, pages 137-138).

5. Teach creating the data file (*Using Microsoft Works*, pages 131-140).

    - Choose Open on the File menu.
    - Choose Database.
    - Click the New button.
    - Type the name of the first field. Press RETURN.
    - Type the name of the second field. Press RETURN.
    - Continue typing field names and pressing RETURN until the file is complete.
    - Click the Done button when the file is complete.
    - To edit any errors in the names of the fields, select the field, choose Change Field Name from the Edit menu, type the new name, and click OK.

- To add fields, choose Add New Field from the Edit menu, type the new name, and click Add Field.
- To size fields, position the pointer on the right edge of the data box. Click-hold-drag to increase or decrease the size of the box.
- The fields can also be rearranged on the screen. See *Using Microsoft Works*, pages 149-153 for instructions.
- When the data file looks the way you want it to look, place a data disk in the disk drive and select Save from to File menu (or press Command-S) to save the file format.
- If you want students to begin entering data right away they may now do so.

6. Students enter the data and edit the file. (See Overview of Lesson 13, #6-8, page 138).

7. Students use the data file. (See Overview of Lesson 13, #9, page 138).

LESSON 14
Optional Lesson Creating a Data File on Regions of North America

OBJECTIVE

Students will design a data file for Canadian, Mexican and U.S. regions. They do the research, create a file, formulate hypotheses and analyze data.

COMPUTER(S) NEEDED FOR LESSON

One or more for student use. Printer required.

MATERIALS REQUIRED

1. Research materials that will provide data on a regional basis.
2. Overhead projector.
3. Prepare transparency of FIELDS IN THE STATES DATA FILES (page 152).
4. Duplicate worksheet REPORT (page 64 in Lesson 5).
5. A Microsoft *Works* data disk.

PRESENTATION

1. *Instruction:* Place FIELDS OF STATES DATA FILE transparency on overhead. Ask students to help you determine what fields from those files would be most important and interesting in comparing regions of Canada, Mexico and the U.S. Cross off any that do not apply. Add others they may think worthwhile.
2. Make up an example of a research sheet using those fields plus one for the names of the researchers, one for teacher check and one for students to comment on their editing.
3. You may want to help the class decide what geographical area each region will include. If you cannot find material that breaks each country into regions, they may need to use selected states or provinces from each region instead.
4. Divide into research teams. Each team will be responsible for one or more regions.
5. When the research is done, define conventional terms and abbreviations to be used for each field.
6. Assign teams to computers to create a REGIONS file and enter data.
7. Have students browse through the data, list questions, and formulate hypotheses.

8. Have pairs of students from each team select an hypothesis on which to report. They could use REPORT worksheets as their guides.
9. Have students present their findings orally or in displays.

FIELDS IN THE STATES DATA FILE

- State
- PO Abbreviation
- Region
- Admitted
- Area
- Population
- US Representatives
- Pop Density
- Pop Change %
- Forest Acres
- Income
- Unemployment %
- Urban Pop %
- Minority Pop %
- Family Size

- Capital
- Largest City
  - Pop LC
  - Jan High Temp
  - Jan Low Temp
  - July High Temp
  - July Low Temp
  - Elevation
  - Rainfall

- Manufactured Product
- Agricultural Product
- Mining Product

OVERVIEW OF LESSON 15 — Final Projects

Bloom Levels—All

The culminating activity of the unit should be a **big deal**. Students enjoy producing a project they will be proud to show to others. Students will choose the most interesting of their hypothesis test reports and polish and expand them into a presentation or display. The hypothesis they choose can be from a data file they have created, a teacher-made file they have worked with, or a commercial file. The final product can be elaborate or simple depending on how much time you want to dedicate to the project.

Some ideas for expanding a report include:

1. Library research to attempt to find underlying causes of a relationship or non-relationship between fields or records.
2. A graph, chart, or piece of artwork to illustrate a relationship.
3. Written analysis of the report that includes: why the topic interested them, the strategies they used, a detailed analysis of the meaning of the data in their report, why their results are of interest, and ideas for further study.
4. A display of tourist materials they have sent for or collected.
5. Recruiting an expert on the topic to speak to the class about the topic of the report.
6. Producing a three dimensional display like a map, model, or diorama that demonstrates the relationship.
7. A wall chart or bulletin board display of results.

To motivate and increase the level of pride in their work, have students present the finished projects to a larger audience. Some presentation options include:

1. Oral reports to parents or another class as a researcher would present a paper at a conference. These should be short summaries of findings and should include visual aids or other media.
2. Invite parents or other classes to tour displays and ask questions of the researchers. The school principal and other staff members could also be invited.
3. Publish a research journal of findings.
4. Challenge groups in other classes to replicate hypothesis tests and hold joint panel discussions to compare results. To do this, you would give a second group a ready-made list of hypotheses to test—those already tested by the first class. Then when they are done bring the groups—and their results—together.

OBJECTIVE

Students will present findings from their hypothesis testing to the class.

COMPUTER(S) NEEDED FOR LESSON

None.

PREPARATION BEFORE CLASS

1. Be sure most of the groups are finished printing their reports and have completed their worksheets.
2. Some groups may want transparencies of their printed reports.

PRESENTATION

1. Congratulate students on all of the learning they have done on the states unit.
2. Tell them that they are now ready to show what they have learned to others.
3. As a group decide who the audience will be.
4. Decide what presentation formats the students can use (see *Student Presentation Options* below).
5. Ask students to choose the most interesting of the hypotheses they tested to use as their project.
6. Have them plan the project and discuss it with you before proceeding.
7. Schedule and plan a day to make presentations. Invite the guests.
8. On presentation day tell the guests how far the students have come in their thinking and computer skills.

STUDENT PRESENTATION OPTIONS

1. *Oral report*: Students divide the presentation equally. The presentation should include:
    a. Stating the hypothesis and why it interested them.
    b. Describing their research strategies and how they corrected any problems.
    c. Summarizing the information they got in their searches.

d. Telling whether or not their analysis of the information supports their hypothesis. (*Would you alter your hypothesis if you were starting again knowing what you know now*?)

e. Commenting on their confidence in their findings. Is there more that could be done?

f. Answering questions from the audience.

2. *Display*: Prepare a wall chart or bulletin board containing the same material as above and including copies of printed reports.

3. Publish "proceedings."

4. Challenge other classes to duplicate studies then compare results in a panel discussion.

Formatting a Data Disk

In order to save data, you will need to format a blank disk. Follow these steps:

1. Insert a blank disk in the disk drive.
2. A dialog box will tell you that you have inserted an unreadable disk and ask if you would like to initialize it. On most Macintosh computers, click **Two-Sided.**
3. You will be warned that all information on the disk will be erased. If you are sure you have inserted a blank disk, click **Erase.**
4. When you are asked to name the disk, type a name and click **OK.**
5. The disk drive will whirr as the dialog box tells you it is formatting and then verifying the format. If you are told the initialization was successful, you may use it for your data. Otherwise, initialize a different disk and discard the failed one.

Saving a File on a Formatted Disk

1. Be sure your file is on the screen.
2. If you are saving a file that has already been saved on the inserted disk, simply select **Save** from the **File** menu (or press **Command-S**).
3. To save a file for the first time, choose **Save As** on the **File** menu. Insert the data disk in the disk drive or, if it is already in click the **Drive** button until the desired disk is selected.
4. Click the **Save** button.

Transferring a File from One Disk to Another

1. Add the file to the desktop.
2. Choose **Save As** on the **File** menu. Insert the "destination" disk in the disk drive or, if it is already in click the **Drive** button until the desired disk is selected.
3. Click on **Save.**

Copying a Data Disk

When a data file has been created you will want to make back-up copies and enough copies for each computer.

IMPORTANT: It is illegal to copy the Microsoft *Works* start-up and program disks (unless you own a legitimate copy). These instructions are for copying data disks or legal back-ups only.

Duplicating a Disk

1. On the Macintosh Finder screen, open the disk you want to copy (double click on it).
2. Choose Select All on the Edit Menu.
3. Insert the "destination" disk and format it if necessary.
4. Click-hold on any one of the files to copy to drag all of the files to the icon of the "destination" disk. Release the mouse button.
5. A dialog box will keep you informed of how the copying process is going.
6. Place a label on the copy.

List of files on the TEACHING THINKING SKILLS WITH DATABASES DATA DISK:

AL BAT CHAMPS
ANIMALS
DRIVERS
EARLY SPACE FLT
ETHNIC AMERICANS (blank records)
GAMES
LIFE EXPECTANCY
LITERACY
MOUNTAINS
MOVIE MONEY
NATIVES
OCEANS AND SEAS
PHONE BOOK
PLANETS
REJECTIONS
RESEARCH FILE (blank records)
STATES
WHO ARE YOU? (blank records)

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APPENDIX D Worksheet Answers

LESSON 1—States in Alphabetical Order

ALABAMA
ALASKA
ARIZONA
ARKANSAS
CALIFORNIA
COLORADO
CONNECTICUT
DELAWARE
FLORIDA
GEORGIA
HAWAII
IDAHO
ILLINOIS
INDIANA
IOWA
KANSAS
KENTUCKY
LOUISIANA
MAINE
MARYLAND
MASSACHUSETTS
MICHIGAN
MINNESOTA
MISSISSIPPI
MISSOURI
MONTANA
NEBRASKA
NEVADA
NEW HAMPSHIRE
NEW JERSEY
NEW MEXICO
NEW YORK
NORTH CAROLINA
NORTH DAKOTA
OHIO
OKLAHOMA
OREGON
PENNSYLVANIA
RHODE ISLAND
SOUTH CAROLINA
SOUTH DAKOTA
TENNESSEE
TEXAS
UTAH
VERMONT
VIRGINIA
WASHINGTON
WEST VIRGINIA
WISCONSIN
WYOMING

LESSON 1—States in Order by Population

State	*Population* (in millions)	*State*	*Population* (in millions)
CALIFORNIA	25.6	COLORADO	3.2
NEW YORK	17.7	CONNECTICUT	3.2
TEXAS	16.0	ARIZONA	3.1
PENNSYLVANIA	11.9	IOWA	2.9
ILLINOIS	11.5	OREGON	2.7
FLORIDA	11.0	MISSISSIPPI	2.6
OHIO	10.8	ARKANSAS	2.4
MICHIGAN	9.1	KANSAS	2.4
NEW JERSEY	7.5	WEST VIRGINIA	2.0
NORTH CAROLINA	6.2	UTAH	1.7
GEORGIA	5.8	NEBRASKA	1.6
MASSACHUSETTS	5.8	NEW MEXICO	1.4
VIRGINIA	5.6	MAINE	1.2
INDIANA	5.5	HAWAII	1.0
MISSOURI	5.0	IDAHO	1.0
WISCONSIN	4.8	NEW HAMPSHIRE	1.0
TENNESSEE	4.7	NEVADA	9
LOUISIANA	4.5	RHODE ISLAND	.9
MARYLAND	4.3	MONTANA	.8
WASHINGTON	4.3	NORTH DAKOTA	.7
MINNESOTA	4.2	SOUTH DAKOTA	.7
ALABAMA	4.0	DELAWARE	.6
KENTUCKY	3.7	ALASKA	.5
OKLAHOMA	3.3	VERMONT	.5
SOUTH CAROLINA	3.3	WYOMING	.5

LESSON 3—Explore

1. 8 states
2. Nevada
3. New York
4. 586 thousand square miles, .5 million
5. 9 states
6. Alaska, Texas, California, Montana, New Mexico, Arizona, Nevada, Colorado, Wyoming (any two)
7. Bismarck
8. New York
9. Vermont
10. Louisiana
11. Nevada
12. Texas

LESSON 4—Select

1. State equals or begins with Kansas, Topeka
2. Income equals or begins with 11, Arizona, Georgia, Indiana, Oklahoma, Oregon, South Dakota
3. Largest City equals or begins with Birmingham, Alabama
4. State equals or begins with Pennsylvania, Philadelphia
5. State begins with O, 3 (Ohio, Oklahoma, Oregon)
6. Region equals or begins with MID ATL, New Jersey, New York, Pennsylvania
7. Two selections: State equals or begins with North Carolina and State equals or contains Georgia, Georgia (59,000 square miles)
8. State equals or begins with Washington, 1889
9. Admitted is greater than 1889, Wyoming (1890), Idaho (1890), Utah (1896), Oklahoma (1907), New Mexico (1912), Arizona (1912), Hawaii (1959), Alaska (1959)

LESSON 10—Scatter Graph

A. New York
B. California
C. Texas
D. Alaska
E. Oregon's dot is the second one up from the top of the "100" label.

LESSON 13—Where Does Oregon Stand?

37 in alphabet
10 in area
30 in population
39 in population density
13 or 14 or 15 (tie) in population change percent
32 or 33 (tie) in income
8 or 9 (tie) in unemployment
33 in year admitted
21 in population of the largest city
42 in elevation
25 in rainfall
47 or 48 (tie) in July high temperature
11 or 12 or 13 (tie) in January low temperature
unemployment
July high temperature
rainfall

LESSON 13—Explore—Oregon Counties

1. Harney, Malheur, Lake
2. 6
3. Multnomah, Lane, Washington
4. 2
5. Willamette Valley

category	The topic or heading under which data can be entered in a database file; commonly referred to as fields.
click-hold-drag	An operation using the mouse to select a point on the screen and move an object, highlight or border to another part of the screen. To click-hold-drag, maneuver the cursor over the point to be selected, press and hold the mouse button, and move the mouse to drag the target object to the desired location. When the object is in its proper position, release the mouse button.
comparison information	A word, phrase, or number that describe what entries are to be displayed when selecting certain records.
cursor	A position indicator on the screen that can be moved in various directions.
data file	A large collection of related data generally accessible by computer. Often simply called a database.
database program	An application program that helps you to input, organize, retrieve, and output information.
database reports	A component of a database program that enables users to format how data will appear when outputted to a printer (or the screen).
default	Values for options that are selected for you by the program as the most likely choice. For example, Microsoft *Works* includes default values for the size of the margins and the characters per inch. Users can almost always change the default values.
delete file	To erase a file that is stored on a data disk.
desktop	Microsoft *Works'* metaphor for the workspace allocated for your files within the computer's memory (RAM). You may have up to 12 files on the desktop at one time.
entry	The information entered into each field of a data file.
evaluation	The ability to assess, compare, conclude, contrast, judge or weigh combinations of data. (Chamberlain, 1986).
field	The generic topic or heading under which data can be entered in a database file.
file	A collection of information stored under a single name either on disk and/or in the computer's memory.

format a blank disk	To set up or initialize a disk so that it can store files. Various operating systems require that disks be formatted in a particular way. This explains why disks formatted for Macintosh computers cannot be read by other machines.
formats	Set ways of printing out data. In the Microsoft *Works* database there are two general formats, tables or labels.
global	Referring to an entire document; not limited to the local component.
hard copy	A copy of a file printed on paper.
header	Text that is repeated at the top of each page.
hypothesis	A possible answer to a question or problem.
highlighted text	Text displayed on the screen with dark letters on a light background.
insert cursor	The edit mode in which typed characters "push" existing characters to the right rather than replace existing text. A blinking line indicates that you are functioning in this mode.
labels report	One of the two types of formats in the database. It features multiple line output that can be arranged according to the needs of the user. Mailing labels are created using this type of format.
layout	How a record appears on the screen.
limiter	Words or phrases that set the criteria for selecting records. Examples include: equals, greater than, less than, does not equal.
menu	A list of options that can be chosen by selecting the menu name and pressing the RETURN key.
merge	To combine two or more data files.
mouse	An input device usually used to select menu items or position the cursor on the screen. Also used to reposition or resize objects or select a section of a file (see click-hold-drag).
multiple record format	The type of screen display in the database in which each record appears on one line; a list format.
overstrike cursor	This cursor causes typed characters to replace existing ones at the same position. A blinking box indicates that you are in this mode.
platen width	The distance that the print head will travel across the printer. The default platen width for a standard printer in 8.5 inches.
prompt	A message on the screen telling the user what can or should be done next.

RAM	A computer's general purpose memory. RAM (random access memory) is volatile; that is, programs and data stored in RAM disappear when the computer's power is turned off. The Microsoft *Works* program and your Microsoft *Works* data files are both stored in RAM during use, and saved on disks when the computer is not in use.
record	A collection of related data treated as a unit. In the STATES unit a record contains all of the information pertaining to one state.
remove file	Refers to eliminating a file from the Desktop (RAM).
scroll	Move information on the screen to bring new lines or columns into view.
select records	Set criteria for displaying certain records while those that do not meet the criteria are omitted.
single record format	A display mode in which all of the information pertaining to one database record is on one screen.
sort	Arrange.
spreadsheet:	A sheet of paper contain information arranged in rows and columns.
spreadsheet program	An application program that enables calculations to be done to data arranged in rows and columns. Spreadsheet programs allow users to create formulas with variables, thus facilitating "what if" projections.
synthesis	"Putting parts together to form a new Whole. Creating new products, plans, communications or relationships." (McAlpine, 1987).
tables report	A database report format in which files are printed as a list with one record on each line.
tiers	Levels of record selection criteria. The first criteria is the first tier, the second criteria is the second tier, and so forth. Microsoft *Works* allows up to six tiers.
word processing program	An applications program that enables users to enter, edit, and print text.
wordwrap	A word processing feature that automatically moves a word to the next line if it doesn't fit on the line in which it was entered.

APPENDIX F Transparency/Worksheet List

Title *Page Number*

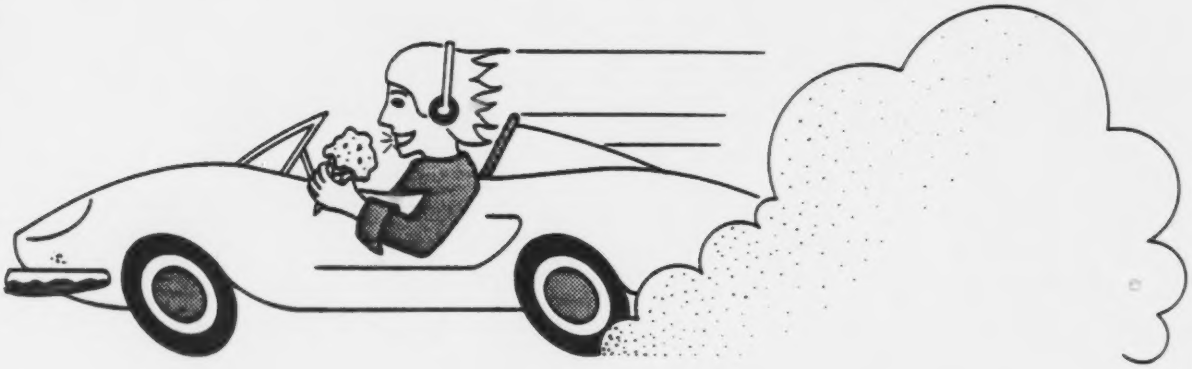
State Population Card ... 16-20
Alabama Record ... 25
Alaska Record ... 26
Arizona Reciord ... 27
Arkansas Record ... 28
California Record ... 29
Colorado Record ... 30
Connecticut Record ... 31
Meanings ... 32
Parts of a Database ... 38
Games Sample File 1 ... 39
Games Sample File 2 ... 40
Area Report —Before Arranging ... 41
Area Report—After Arranging ... 42
Explore ... 43
Movie Money Sample File ... 53
Select Records 1 ... 54
Limiters ... 55
Select Records 2 ... 57
Select ... 58
Animals Sample File ... 63
Report ... 64
How to Print ... 65
Representative Report ... 71
Mountains Sample File ... 77
List/Question Starters ... 78
Life Expectancy Sample File ... 83
Hypotheses ... 84
Literacy Sample File ... 89
Oceans and Seas Sample File ... 90
Hypothesis Starters ... 91
Drivers Sample File ... 100

Title *Page Number*

American League Batting Champs Sample File 1 101
American League Batting Champs Sample File 2 102
Early Space Flight Sample File 103
Analysis Data 104
Analysis Worksheet 105
Scatter Graph 106
Area and Population of U.S. States 107
Urban Density 1 117
Urban Density 2 118
Think About It Problem Sheet 1 119
Think About It Problem Sheet 2 120
Think About It Assignment Sheet 1 121
Think About It Assignment Sheet 2 122
Rejections Sample File 129
Phone Book Sample File 130
To Database or Not To Database 131
What Should You Do To That Baseball File 134
What Should You Do To That Baseball File Answer Sheet 135
Research Assignment: States 140
Data Entry and Editing Instructions 143
Research Assignment: Oregon Counties 146
Where Does Oregon Stand? 147
Explore—Oregon Counties 148
Fields in the States Data File 152

APPENDIX G

Related Articles



The Data Base: Getting to Know You

by
Larry Hannah

Here's a good beginning-of-the-year activity to introduce students to the data base and each other at the same time. You start by creating a data base template (and a worksheet) that includes blanks for students to fill in their names and a wide variety of favorite things, such as musical group, pizza topping, female athlete, etc. (see figure 1). Have students pair off and interview their partners, filling in the sheets for each other and then entering the data into the data base.

From here, the data base students have created can be used for a number of activities. Three are outlined below.

Team Activity

This activity helps students learn to use the Arrange strategy for searching a data base. It's patterned after the TV game show "Family Feud." Even if you or your students haven't seen the show, the rules are easy enough for anyone to follow.

You'll be using the chalkboard; a computer running the "favorites" data base; another computer, with a large monitor, running the "scorekeeper" spreadsheet (figure 2); and some railroad board to make signs for the teams. Figure 3 shows a good way to arrange the classroom for this activity.

Setting Up

Have the class count off by threes to create three teams. Give each team a piece of railroad board and a marker and allow them a few minutes to come up with a team name and create a sign. Then determine the order of play: Two groups will be playing while the third serves as judge and does the sorts at the computer. Post the order of play on another piece of railroad board. A member of the judging team will keep score with the spreadsheet on the large monitor, and another will record responses and point values on the chalkboard to keep players from using the same response more than once.

FAVORITES

Fill in your last name and first name. After that, list your favorite for each category. After you have finished, you will be entering the answers into a data base on the computer.

Last name: ____________
First name: ____________
Musical group: ____________
Musical instrument: ____________
Male singer: ____________
Female singer: ____________
Song: ____________
Fast food rest.: ____________
Food dish: ____________
Vegetable: ____________
Fruit: ____________
Ice cream: ____________
Pizza topping: ____________
Sport: ____________
Male athlete: ____________
Female athlete: ____________
School subj. (favorite): ____________
School subj. (least fav.): ____________
TV soap opera: ____________
Car: ____________
Computer: ____________
Toothpaste: ____________
Athletic shoe: ____________
Designer label: ____________
Actor: ____________
Actress: ____________
Holiday: ____________
Collection: ____________
Hobby: ____________
Zodiac sign: ____________

Figure 1.

	A	B	C	D
1	**Round 1**	Team A	Team B	Team C
2	Question 1	16	7	
3	Question 2	12	14	
4	Question 3	9	12	
5	Question 4	10	17	
6	Total for Round 1	@sum(B2...B5)	@sum(C2...C5)	@sum(D2...D5)
7				
8	**Round 2**	Team A	Team B	Team C
9	Question 1		16	9
10	Question 2		10	7
11	Question 3		8	15
12	Question 4		12	15
13	Total for Round 2	@sum(B9...B12)	@Sum(C9...C12)	@Sum(D9...D12)
14				
15	**Round 3**	Team A	Team B	Team C
16	Question 1	10		7
17	Question 2	10		11
18	Question 3	9		17
19	Question 4	13		13
20	Total for Round 3	@Sum(B16...B19)	@Sum(C16...C19)	@Sum(D16...D19)
21				
22	Grand Total	+B6+B13+B20	+C6+C13+C20	+D6+D13+D20

Figure 2.

This spreadsheet template shows sample scores along with the formulas needed to sum them.

Playing the Game

Play begins when the emcee (teacher) poses a question, such as "Name a fast food restaurant." The first team to answer gains control of the board, and four team members (including the one who first answered) will have the opportunity to give answers. Each time an answer is given, the judging team arranges the data base to find how many students gave that response on their questionnaires. That number of points is then awarded to the team.

The answers and their point totals are recorded on the board, and the points are also recorded on the spreadsheet. Then the second team has a chance to give four responses to the same question. None of the answers may be repeated.

Any disputes over student responses will be settled by the judging team. That team will also ask for a more specific answer when required.

Continue this way until the teams have answered four questions, then rotate the teams among playing and judging. Eventually each team will have played two games, one against each of the other teams. The team which has stacked up the most points wins, technically. But each student comes out a winner, having learned to sort and arrange data base information.

Individual Activity

With this activity students will learn to use the Find strategy.

Have each student identify his/her favorites for three categories on a worksheet (see figure 4 on page 41). Then send students to the computer, worksheet in hand, to find those who chose the same favorites. Next have them write down the names of kids who shared the same favorite under each category and look through their lists to find someone who shared all three favorites. (If there is no match, have them find someone who chose two of the same.) Then have them locate that student in the classroom to sign the bottom of their worksheet. This way kids will meet others who share some of their interests; information that they may never have known about otherwise.

Record Selection Activity

Make up a worksheet which poses questions that will require students to use the Record Selection strategy. Here are some samples from my class:

- One person chose The Police as the favorite musical group. What is that person's favorite musical instrument?
- Who would be delighted if Carl's Jr. served fried shrimp?
- He came roaring down the street in his Ferrari, listening to David Lee Roth and eating maple ice cream. What toothpaste had he used to get those teeth so bright?

I include all students in this activity by making each of their names appear in the searches. The activity is fun for everyone and gives a lot of practice in record selection.

Try these activities in your classroom. They help kids identify others who share interests, and they introduce data bases in a fun way.

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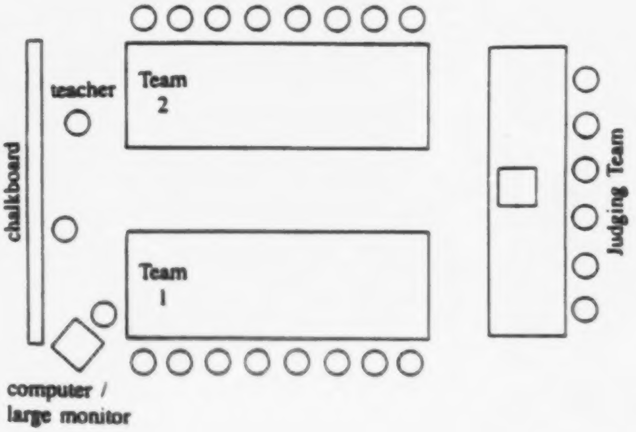


Figure 3.

INDIVIDUAL ACTIVITY

Name: ______________________

Choose three categories from the list. Sort through those categories to find people who listed the same favorites for each of those three, then compare to find a person who shares all three favorites. If no one shares all three, find one who shares two. After you have found that person, have her/him sign this form at the bottom.

Category 1: ______________________

Your Response: ______________________

People who shared that response:

______________ ______________

______________ ______________

______________ ______________

Category 2: ______________________

Your Response: ______________________

People who shared that response:

______________ ______________

______________ ______________

______________ ______________

Category 3: ______________________

Your Response: ______________________

People who shared that response:

______________ ______________

______________ ______________

______________ ______________

Name of person who shared two or three: ______________________

Signed: ______________________

Figure 4.

The Computing Teacher June 1987

Teaching Data Base Search Strategies

by
Larry Hannah

It is tough finding ways to get students to probe into content, ask critical questions, and test their conclusions. But data base activities have the potential to aid students in developing these higher-level thinking skills. They can provide opportunities for students to analyze data, develop theories and evaluate their ideas. These skills can be involved in *creating* a data base—deciding what categories to include, researching the data for each category, resolving conflicts between sources, etc. But a wealth of opportunity for developing creativity as well as analysis, synthesis and evaluation skills lies in *searching* a data base that students have created or that has been provided to them.

For students to be successful at activities that involve searching a data base, they need to know the types of searches available for the data base they are using, and they need to know which search strategy is most effective for a particular type of question. I have found that if you don't systematically guide students to analyze the question and consider each strategy, they will find one strategy that works for them and then use it no matter what question comes before them. Allowing this leaves thinking at lower levels and frequently leads to incorrect conclusions. Training students to focus on data base search strategies will help them to learn more about the content they are studying as well as to become better and more critical thinkers.

The three basic search strategies are: **arranging** the records based on the content of any one category (field); **finding** all records that contain a specified word or phrase; and **selecting** all records that meet a specified set of criteria.

Here are some sample searches using a data base on U.S. presidents and vice-presidents:

- Students can **arrange** all records chronologically based on the year the president went into office. With the records arranged in this fashion, it is easy to see the introduction, progression and change of political parties.
- Students can **find** all records that contain the phrase "cal" when they are seeking to identify presidents or vice-presidents from California. (They also get records containing *Cal*vin Coolidge and John C. *Cal*houn.)
- They can **select** all records in which the president's party is "Dem" and the president's prior job was "general." While students could have arranged the data by party or found the records that contained "general," the record selection strategy eliminates Democratic presidents who hadn't been generals and all Republican generals.

Classroom Activities

I have used the following activities with students as young as the sixth grade. They are appropriate for fifth grade through high school. The activities assume access to a lab where the ratio of students to computers is two or three to one. The worksheets have been designed for the *AppleWorks* data base, but may be adapted for others.

Introduce arrange and find strategies using the presidents and vice presidents data base on page 17. Give students a printed copy of the data base so they don't have to guess at abbreviations. Use the worksheet on page 22 for introducing the arrange and find strategies. Have students complete DB Worksheet I on page 51. You may wish to use the worksheets in figure 1 as overhead transparencies. I find them useful when discussing the various strategies. They can also help students plan their searches and serve as records of what they did in case it's necessary to trace an error.

After students have completed the worksheets, guide them through the questions in figure 2 for practice. After each question is presented and students have found their answers:

- Ask for answers and strategies used.
- Check to see if different students solved the question using different strategies.
- Discuss strategies.
- Compare to see which strategy gives the most "exclusive" answer.
- Check for accuracy using the printed copy.
- Did incorrect answers crop up that could be traced to the strategy? (e.g., no Democratic presidents because the abbreviation was "dem" rather than "demo" or "democrat."
- If unanticipated answers appear (e.g., Calvin Coolidge when seeking California presidents), check to see why these were selected. (This will happen most frequently with find.)

Now introduce record selection using the worksheets beginning on page 23. Have students complete DB Worksheet II on page 51. Venn diagrams, such as those in figure 3, help students understand the record selection strategy.

After students have completed the worksheets, repeat the oral questions in figure 2. While discussing the questions, add this item to the list above:

- Ask "Why is record selection better than the previously used strategies?"

Team Activities

The next activities focus on the data base's vice president records. This is easiest to do if the categories on the presidents are temporarily deleted from the screen. To do this, be sure you are in the multiple record layout and tap Open Apple-L (change the layout). Use Open Apple-D to temporarily delete all the categories on the presidents, one at a time. The other layout options can be used to narrow or widen the remaining categories so that all the information is visible on the screen without any category taking more space than it needs.

Have each student write three questions that s/he thinks would be solved best using each of the strategies—arranging, finding and selecting. Then form pairs of students and have them merge their lists by selecting the three best questions for each category and creating a new list with their best questions mixed (not grouped by strategy). (This is a good opportunity to practice the copy function while using *AppleWorks'* word processor.)

Have each pair swap questions with another pair, answer each other's questions, and identify the search strategy they think most appropriate for each question. Then have them mark the single best question for each of the three search strategies. Have the two pairs meet to discuss answers, focusing on the intended search strategy and the strategy the solving team thought was most appropriate. Have them explain to each other their differences in opinion.

Next, create handouts of the best questions, with one strategy to a page. Provide room at the bottom for students to identify: 1) Which two questions from this sheet were particularly good for solving by finding, etc., and 2) what factor(s) made these particularly good questions for solving by that method. Pass these out to the teams and have them complete them. Figure 4 is a sample of actual student-generated questions for the three search strategies.

Conclusion

Now that my students have gone through this "training session," they are able to perform much more efficient searches. They have learned to analyze the question before wasting time on trial and error or simply trying their favorite strategy. And they all take pride in their ability to design search strategies that give precise answers.

[Larry Hannah, California State University, Sacramento, CA 95819.]

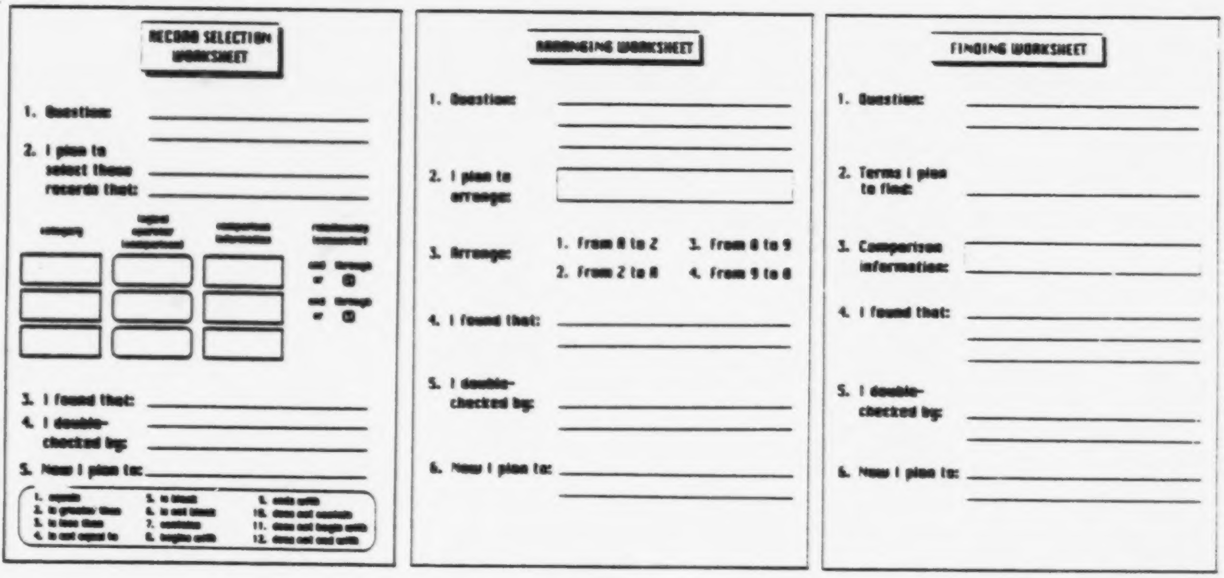
Presidents and Vice Presidents Data Base

The presidents and vice presidents data base is presented for your information, not as an example of perfect organization. A good extension of the activities here is to have students critique the category choices and come up with a better way to organize the information. Note that "State B/A" refers to the states of birth and adult life.

President	Pr. Term Office	Pr. Party	Pr. State B/A	Pr. Prior Job	Pr. Notes
Washington, George	1789-1797	Fed	VA	General	
Adams, John	1797-1801	Fed	MA	VPres	Elected
Jefferson, Thomas	1801-1809	DR	VA	VPres	Elected
Jefferson, Thomas	1801-1809				
Madison, James	1809-1817	DR	VA	Secty of State	
Madison, James	1809-1817				
Monroe, James	1817-1825	DR	VA	Secty of War	
Adams, John Q.	1825-1829	DR	MA	Secty of State	Def for reelect 1828
Jackson, Andrew	1829-1837	Dem	SC/TN	US Sen (Tenn)	
Jackson, Andrew	1829-1837				
Van Buren, Martin	1837-1841	Dem	NY	VPres	Def for reelect; Cand (Free Soilers) 1848
Harrison, William H.	1841-1841	Whig	VA/OH	County recorder	Died (illness)
Tyler, John	1841-1845	Whig	VA	VPres	
Polk, James K.	1845-1849	Dem	NC/TN	Gov (Tenn)	
Taylor, Zachary	1849-1850	Whig	VA	General	Died (illness)
Fillmore, Millard	1850-1853	Whig	NY	VPres	Cand (American Party "Know Nothings") 1856
Pierce, Franklin	1853-1857	Dem	NH	General	
Buchanan, James	1857-1861	Dem	PA	Diplomat	
Lincoln, Abraham	1861-1865	Rep	KY/IL	Lawyer	
Lincoln, Abraham	1865-1865				Died (assassinated)
Johnson, Andrew	1865-1869	Union	NC/TN	VPres	Impeached
Grant, Ulysses S.	1869-1877	Rep	OH	General	
Grant, Ulysses S.	1869-1877				
Hayes, Rutherford B.	1877-1881	Rep	OH	Gov (Ohio)	
Garfield, James A.	1881-1881	Rep	OH	US House	Died (assassinated)
Arthur, Chester A.	1881-1885	Rep	VT/NY	VPres	
Cleveland, Grover	1885-1889	Dem	NJ/NY	Gov (NY)	Def for reelect 1888
Harrison, Benjamin	1889-1893	Rep	OH	US Sen (Ind)	Def for reelect 1892
Cleveland, Grover	1893-1897				
McKinley, William	1897-1901	Rep	OH	Gov (Ohio)	
McKinley, William	1897-1901				Died (assassinated)
Roosevelt, Theodore	1901-1909	Rep	NY	VPres	Cand for Pres (Progressive) 1912
Taft, William Howard	1909-1913	Rep	OH	Secty of War	Def for reelect 1912

Wilson, Thomas Woodro	1913-1921	Dem	VA/NJ	Gov (NJ)	
Harding, Warren G.	1921-1923	Rep	OH	US Sen	Died (illness)
Coolidge, John Calvin	1923-1929	Rep	VT/MA	VPres	
Hoover, Herbert	1929-1933	Rep	IA/CA	Secty of Commerce	Def for reelect 1932
Roosevelt, Franklin	1933-1945	Dem	NY	Gov (NY)	
Roosevelt, Franklin	1933-1945				
Roosevelt, Franklin	1933-1945				Died (illness)
Truman, Harry S.	1945-1953	Dem	MO	VPres	
Eisenhower, Dwight	1953-1961	Rep	TX/NY	General (NATO)	
Kennedy, John F.	1961-1963	Dem	MA	US Sen (Mass)	Died (assassinated)
Johnson, Lyndon B.	1963-1969	Dem	TX	VPres	
Nixon, Richard M.	1969-1974	Rep	CA	Attorney	VPres (1952-1960)
Nixon, Richard M.	1969-1974				VPres (1952-1960); resigned
Ford, Gerald R.	1974-1977	Rep	NE/MI	VPres (appointed)	Def for reelect 1976
Carter, James E.	1977-1981	Dem	GA	Gov (Ga)	Def for reelect 1980
Reagan, Ronald	1981-1984+	Rep	IL/CA	Gov (Cal)	

Vice-Pres	VP Term Office	VP Party	VP State B/A	VP Prior Job	VP Notes
Adams, John	1789-1797	Fed	MA	Diplomat	Elected pres 1796
Jefferson, Thomas	1797-1801	DR	VA	Secty of State	Elected pres 1800
Burr, Aaron	1801-1805	DR	NJ/NY	US Sen (NY)	Indicted for treason
Clinton, George	1805-1812	DR	NY	Gov (NY)	
Clinton, George	1805-1812			VPres	Died in office
Gerry, Elbridge	1813-1814	DR	MA	Gov (Mass)	Died in office
Tompkins, Daniel D.	1817-1825	DR	NY	Gov (NY)	
Calhoun, John C.	1825-1832	DR	SC	Secty of State	
Calhoun, John C.	1825-1832	Dem	SC	VPres	Resigned to become Sen; changed parties 1828
Van Buren, Martin	1833-1837	Dem	NY	Secty of State	Elected pres 1836
Johnson, Richard M.	1837-1841	Dem	KY	US Sen (1819-1829)	
Tyler, John	1841-1841	Whig	VA	US Sen (1827-36)	Became pres on death of Harrison
none	1841-1845				
Dallas, George M.	1845-1849	Dem	PA	Diplomat	
Fillmore, Millard	1849-1850	Whig	NY	Comptroller (NY)	Became pres on death of Taylor
none	1850-1853				
King, William R.	1853-1853	Dem	NC/AL	US Sen (Ala)	Died in office
Breckinridge, John C.	1857-1861	Dem	KY	US House	Cand pres 1860; indicted for treason; Gen & Secty War CSA
Hamlin, Hannibal	1861-1865	Rep	ME	US Sen	
Johnson, Andrew	1865-1865	U/D	NC/TN	Gov (Tenn)/Military	Became pres on death of Lincoln
none	1865-1869				
Kolfax, Schuyler	1869-1873	Rep	NY/IN	US House (Ind)	
Wilson, Henry	1873-1875	Rep	NH/MA	US Sen (Mass)	Died in office
Wheeler, William A.	1877-1881	Rep	NY	US House	
Arthur, Chester A.	1881-1881	Rep	VT/NY	Collector	Became pres on death of Garfield
none	1181-1885				
Hendricks, Thomas A.	1885-1885	Dem	OH/IN	Gov (Ind)	Died in office
Morton, Levi P.	1889-1893	Rep	VT/NY	Banker (NY)	
Stevenson, Adlai E.	1893-1897	Dem	KY/IL	Asst Postmaster	
Hobart, Garrett A.	1897-1899	Rep	NJ	Lawyer, businessman	Died in office
Roosevelt, Theodore	1901-1901	Rep	NY	Gov (NY)	Became pres on death of McKinley
Fairbanks, Charles W.	1905-1909	Rep	OH/IN	US Sen (Ind)	
Sherman, James S.	1909-1912	Rep	NY	US House	Died in office
Marshall, Thomas R.	1913-1921	Dem	IN	Gov (Ind)	
Coolidge, Calvin	1921-1923	Rep	VT/MA	Gov (Mass)	Became pres on death of Harding
Dawes, Charles G.	1925-1929	Rep	OH/IL	Banker/financier	
Curtis, Charles	1929-1933	Rep	KS	US Sen (Kan)	
Garner, John N.	1933-1941	Dem	TX	US House	
Wallace, Henry A.	1941-1945	Dem	IA	Secty of Agriculture	
Truman, Harry S	1945-1945	Dem	MO	Us Sen	Became pres on death of Roosevelt
Barkley, Alben W.	1949-1953	Dem	KY	US Senate	
Nixon, Richard M.	1952-1961	Rep	CA	US Sen	Cand for pres 1960, 1968 (elected)
Johnson, Lyndon B.	1961-1963	Dem	TX	US Sen	Became pres on death of Kennedy
Humphrey, Hubert H.	1965-1969	Dem	SD/MN	US Sen (Minn)	Cand for pres 1968
Agnew, Spiro T.	1969-1973	Rep	MD	Gov (Md)	Resigned
Ford, Gerald R.	1973-1974	Rep	NE/MI	US House (Mich)	Appointed VP; became pres on resignation of Nixon
Rockefeller, Nelson A.	1974-1977	Rep	ME/NY	Gov (NY)	Appointed when Ford became president
Mondale, Walter F.	1977-1981	Dem	MN	US Sen	Cand for pres 1984
Bush, George	1981-1984+	Rep	MA/TX		



RECORD SELECTION WORKSHEET

1. Question:
2. I plan to select these records that:
3. I found that:
4. I double-checked by:
5. Now I plan to:

ARRANGING WORKSHEET

1. Question:
2. I plan to arrange:
3. Arrange: 1. From A to Z 2. From Z to A 3. From 0 to 9 4. From 9 to 0
4. I found that:
5. I double-checked by:
6. Now I plan to:

FINDING WORKSHEET

1. Question:
2. Terms I plan to find:
3. Comparison information:
4. I found that:
5. I double-checked by:
6. Now I plan to:

Figure 1.

Quick Questions:

Data Base Presidents

Use these questions both after students have learned Find and Arrange and after learning Record Selection.

1. Which presidents served between 1853 and 1889?

   Pierce, Buchanan, Lincoln, Johnson, Grant, Hayes, Garfield, Arthur, Cleveland

2. (After explaining the category "Pr St B/A" [B=state in which president was *born*; A=state from which elected as an *adult*])

   How many presidents were born in Ohio? Who were they?

   Grant, Hayes, Garfield, Harrison, McKinley, Taft, Harding

3. How many presidents were elected as adults from New York but were not born in New York?

   Cleveland, Eisenhower, Arthur
   [Record selection strategy: Pr St B/A contains NY AND Pr St B/A does not begin with NY]

4. Who was the last Whig president?

   Fillmore

5. How many presidents had the prior job of vice president? Who were they?

   12 Ford, Adams, Arthur, Coolidge, Fillmore, Jefferson, Andrew Johnson, Lyndon Johnson, Theodore Roosevelt, Harry Truman, John Tyler, Martin Van Buren

6. Which president(s) was/were impeached?

   Andrew Johnson

7. Which party had the least number of presidents?

   Union

8. Who was the only president born in California?

   Nixon

Figure 2.

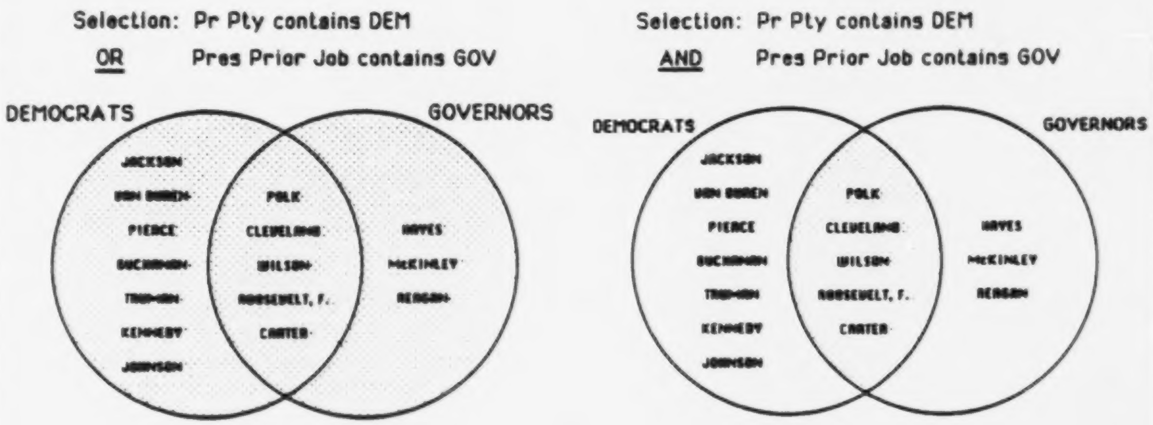

Selection: Pr Pty contains DEM
OR Pres Prior Job contains GOV
DEMOCRATS
GOVERNORS
JACKSON
VAN BUREN
PIERCE
BUCHANAN
TRUMAN
KENNEDY
JOHNSON
POLK
CLEVELAND
WILSON
ROOSEVELT, F.
CARTER
HAYES
McKINLEY
REAGAN
Selection: Pr Pty contains DEM
AND Pres Prior Job contains GOV
DEMOCRATS
GOVERNORS
JACKSON
VAN BUREN
PIERCE
BUCHANAN
TRUMAN
KENNEDY
JOHNSON
POLK
CLEVELAND
WILSON
ROOSEVELT, F.
CARTER
HAYES
McKINLEY
REAGAN

Figure 3.

Questions on the Vice-Presidency

Finding (⌘F)

1. How many vice-presidents were appointed? Who were they?
2. List the vice-presidents whose name had "John" in it.
3. In what years was there no vice-president?
4. Who was vice-president in 1929?
5. Which vice-presidents died in office?
6. During what period of time was Calvin Coolidge vice-president?
7. Which vice-presidents were indicted for treason?

Arranging (⌘F)

1. How many vice-presidents' last name started with the letter C?
2. How many vice-presidents were born in Kentucky?
3. Name all vice-presidents who served before 1800.
4. Who was the first vice-president to hold office after 1800?
5. Which state has been the birth site of the most vice-presidents? How many were born there? Who were they?
6. Which vice-presidents were born in New York? List them in reverse alphabetical order.
7. Which vice-presidents were governors just before their election as vice-president?

Record Selection (⌘F)

1. Identify all vice-presidents born in Kansas whose prior job was U.S. Senator.
2. Name the vice-presidents who were Democrats and had previously served as governor.
3. Which vice-presidents were governors from Mass.?

4. List all vice-presidents who had served in the Senate in the 19th century as Democrats.
5. List the vice-president whose prior job was Secretary of State and who was from Virginia.
6. Which former governor of Indiana died in office as vice-president?
7. Which vice-presidents who were not Democrats or Republicans were later elected as president?
8. Which vice-president's term began and ended in 1841? Why?
9. Name all vice-presidents whose prior job was U.S. Senator and who subsequently were elected to the presidency.
10. From those vice-presidents who took office as president after 1920, which one served in the Senate before election as vice-president?
11. How many Democratic vice-presidents served in the 19th century who were not born in New York?

Figure 4.

Introduction to Searching in the AppleWorks Data Base Management Program
Part I

Load the president and vice president data base. Searches are generally easier in multiple-record layout. Switch to that mode by pressing ⌘-Z if you aren't in it already.

Arranging Records

1. You can arrange all of the records in an *AppleWorks* data base file based on the information in a single category (e.g., Pr Term Off). The category can be arranged in any one of four ways: (1) from A to Z (alphabetical order); (2) from Z to A (reverse alphabetical); (3) from 0 to 9 (smallest to largest number); and (4) from 9 to 0 (largest to smallest number).
2. To arrange the information, use the following steps:
   a. Place the cursor in the category you want to sort;
   —use TAB to move right
   —use ⌘ -TAB to move left
   b. Press ⌘ - A for Arrange;
   c. Select the option you want by typing the number of the choice you want and then RETURN *or* by pressing the ↓ key until your choice is highlighted and then RETURN.
3. Try arranging the categories using different ⌘ - A options.
4. Complete **Part A of DB Worksheet I.**

Finding Records

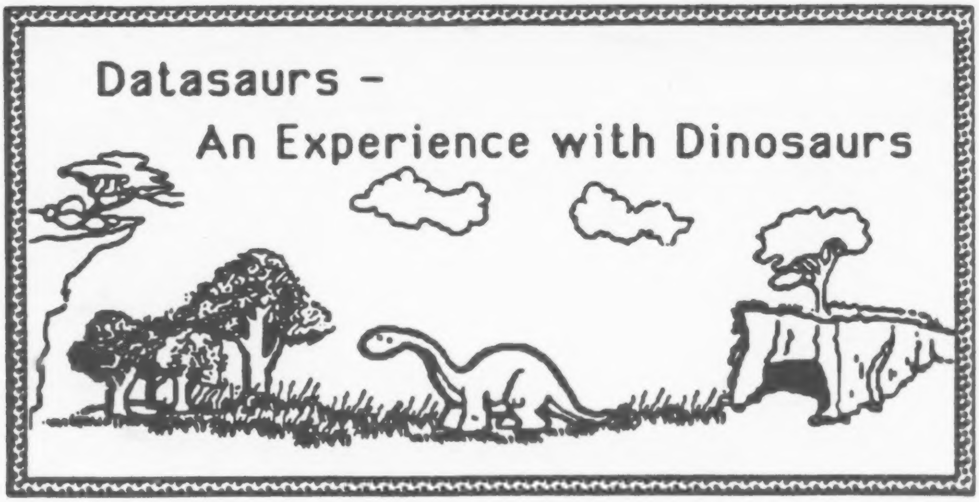
1. You can locate specific information anywhere in your file by using a **Find** search. For example, if you wanted to select all of the files in which the state of Virginia appeared, you could search for all records that included "VA." You also might get a file that included the vice-presidential note "vacationed a lot," but we'll show you how to check for that in a moment.
2. To conduct a "**Find**" search, use the following steps.
   a. Press ⌘ - F for Find.
   b. The message "Type comparison information: " will appear at the bottom of the screen.
   c. Let's assume that you do want to find all of the records that include "VA." Type VA and press RETURN.
   d. Eleven records should be displayed. Only eight of these records show "VA" in column "pr St B/A." Check each of the other records by using ↓ to move to the appropriate line and then ⌘ - Z to Zoom in on the individual record. List the reasons below.

President	*Reason*
Adams, John	
Jackson, Andrew	
Van Buren, Martin	

3. To return to "All records," press the ESC key.
4. Complete **Part B of DB Worksheet I.**

Brontosaurus Meets the Computer

by
Shirley Krueger, SNJM



"I weighed more than 3,000 boys and girls put together. I also could have looked over a three-story building without stretching. My front legs were longer than my back legs. My nostrils were on top of my head, which made some scientists think that I lived in the water. Now, though, it is thought that the pressure of the water would have crushed my lungs. I was the 'giant of the giants.' Who was I?"

If you are one of the people from the ages of three to 93 who are fascinated with dinosaurs, you might know the answer to that question. However, it is not the answer to the question that is important. What is important is the thinking process students go through to reach the answer.

Developing critical or higher-level thinking skills should be one of our top priorities in education today. Using a unit on dinosaurs as a vehicle to teach these skills gives the students a subject they are so interested in that they are willing to put extra effort into the learning process. "Datasaurs—An Experience with Dinosaurs" is a computer unit that grew from a group project started by the Math Learning Center's "Try Them and Apply Them: Fifth Grade" class during the summer of 1986. The complete unit was fieldtested by the fourth, fifth and sixth grade students at All Saints School in Portland, Oregon, and was very successful. The students enjoyed studying dinosaurs and got a chance to learn and practice thinking skills throughout the unit—both on and off the computer.

Some of the first computer activities in the unit are designed to get students familiar with the program and involve just the knowledge and comprehension levels of thinking. For example, the students concentrate on doing keyword searches using just a "find" command, searching the entire data base of 40 dinosaurs. A typical question would be, "What dinosaur had three great horns and a short, thick nose horn?" Next, the students have to think a little harder to decide which category will have the answer, using a "search" command to search in just one category (see figure 1). Then students are given two categories to search in, and finally three categories. A sample question would be, "What dinosaur lived in the Triassic period, was lizard-hipped, and had a small head on a long neck?"

Moving beyond the knowledge and comprehension level, students are asked to find answers to questions such as, "If Polacanthus and Ornithomimus ran in a marathon, which one would finish first?" In this type of question, students have to decide how to find the answers they need, and then apply that knowledge to distinguish which answer is the correct one.

These questions still have not moved into the higher-level thinking skills of analysis, synthesis and evaluation, so more provoking questions, such as the one at the beginning of this article, are introduced. Here students must sort through the information given in the questions, determine what is pertinent, decide how to use that information, and then find answers to specific parts of the question. If resource books are used in addition to the data base, students will find that not all scientists agree on the answers, so the students have to select criteria for accepting or rejecting answers.

Why Teachers and Students Use Data Bases

Here are a few examples of different purposes for using computer data bases and data management software:

- **Discovering commonalities and differences among groups of events or things.** For example, what are the differences between states that have grown rapidly in population in the past decade versus states that have declined in population? What are the common properties of gasses?
- **Analyzing relationships.** For example, is there a relationship between the distance of planets from the sun and their period of revolution?
- **Looking for trends.** Trace the patterns of change in birthrates in a specific country over the past century. Look for trends in size of households in a country and relate those trends to other demographic factors.
- **Testing and refining hypotheses.** Test the common hypothesis that "good electrical conductors are also good heat conductors" by asking the FILE program to find all the elements that meet each of these criteria separately, and then both of the criteria combined. Are the results surprising? Try a different hypothesis.
- **Organizing and sharing information.** Put the results of your library research about a U.S. president on a data file. If all members of the class store their president's information on the same file, the whole class now has one organized collection of information to use when they want to learn more about any particular president or any group of presidents.
- **Keeping lists up-to-date.** Put names, phone numbers and skills of your club members in a file. As new people join and old members leave, update the file and print out new membership lists.
- **Arranging information in more useful ways.** From a file of data about students, print out a list organized by homeroom, another list organized by bus route, and one of just the band members.

Example Files

Special terms used in talking about data bases are best learned by looking at examples. Figures 2, 3, 4 and 5 show sample portions of four different data files designed and built for students in history, government, physical science and life science. These are from a collection of 24 different files developed by Hunter and Furlong (1,2) and McLeod and Hunter (3,4). Other examples, with lesson plans, are given in *My Students Use Computers* (5).

The files are very different from one another, because each file is designed for a particular set of instructional purposes.

The Inventions file (figure 2) enables students to trace the development of inventions and technology in different fields such as agriculture, textiles, information processing, home/leisure, etc. At this time, there are about 170 different inventions in the file. Of course, students and teachers can add more inventions to the file.

All the information about one invention and its inventor, such as the hot-air balloon shown in figure 2, is on one *record* of the data file. In some data management programs the term used for record is *form.* Within each record or form there are separate *fields* or *data items.* In figure 2, the data item names are in all upper case letters. YEAR: is a field name. 1783 is the data item for YEAR.

```
                    INVENTIONS & TECHNOLOGY
INVENTION: Hot-Air Balloon
YEAR: 1783                                  TYPE: Transportation
DESCRIPTION: A lighter-than-air craft used for flight which consisted
of an impermeable bag filled with hot air.
IMPACT: Resulted in the first manned balloon flight in 1783. Hot-air
balloons are still used today for fun and sport.

                 PRESS CTRL-N TO SEE PAGE 2

INVENTOR: Joseph M. Montgolfier
BORN: 1740                  DIED: 1810                   SEX: M
NATIONAL ORIGIN: France
NEED FOR INVENTION: Need for an improved balloon design.
ENABLING TECHNOLOGY:
—Leonardo da Vinci was first to speculate about flight
—Previous balloon designs
—Montgolfier got the idea of hot air after watching smoke in chimneys

            PRESS CTRL-N FOR REFS; CTRL-P FOR PAGE 1

REFERENCES:
—Encyclopedia Americana, 1980
  Vol. 3
—Collier's Encyclopedia, 1983
  Vol. 16
----------------------------------------------------------------
NOTE: Jacques Etienne Montgolfier was co-inventor with his brother.
```

Figure 2.
Sample invention in the Inventions file.

```
                    PRESIDENTIAL ELECTIONS
YEAR: 1984
                  Political Parties and Candidates
REPUBLICAN: Ronald Reagan
  DEMOCRAT: Walter Mondale
 3RDPARTY1:
 3RDPARTY2:
                      Electoral Vote Results
REPUBLICAN: 525
  DEMOCRAT: 13
 3RDPARTY1:
 3RDPARTY2:
                      Popular Vote Results
REPUBLICAN:            53,428,357  %: 58
  DEMOCRAT:            36,930,923  %: 41
 3RDPARTY1:                        %:
 3RDPARTY2:                        %:
                                        WINNER: Reagan (R)
```

Figure 3.
Part of the election form.

```
Record 5 of 40
SCIENTIFIC NAME: Brontosaurus (BRON-tuh-sawr-us) (also called Apatosaurus)
COMMON NAME: Thunder Lizard
LOCATION: United States (Montana, Wyoming)
WHEN LIVED: Jurassic (middle to late)
WEIGHT (LBS.): 80,000
HEIGHT (FT.): 30
LENGTH (FT.): 70
DESCRIPTION: lizard-hipped; 30-foot whip-like tail; elephant-like feet and legs
  D2:with front legs shorter than rear; small horse-like head on long neck;
  D3: neck longer than body; brain size of human fist; small, pig-like teeth
DIET: herbivore; ate twigs and needles of pine, fir, and sequoia trees
MOVEMENT: quadruped
OTHER: correct name is Apatosaurus (Deceptive Lizard); best-known of all
  02: dinosaurs; one of largest known; probably traveled in herds; originally
  03: thought to have lived in water, probably plains and forest dweller
```

Figure 1.

A sample record from the dinosaurs data base.

Finally, they have to put all the parts together to decide on the correct dinosaur. (Did *you* come up with the correct answer of Brachiosaurus?)

Another important thinking skill for students to develop is **classification** of data into categories. Classification skills are important for many subject areas and can be taught effectively with this unit. The students first learn the attributes used to place dinosaurs into orders and suborders. For example, the order Saurischia is distinguished by the attributes "lizard-like hips and clawed feet, some biped, some quadruped, some carnivore, some herbivore, some omnivores" (see figure 2). Once they understand the attributes associated with the orders and suborders, the students are divided into groups and each group is assigned a suborder. Searching the data base, each group must find all of the dinosaurs included in its suborder and list them on a large wall chart. Much to the students' dismay, they find some of the same dinosaurs listed under different suborders. The groups then tell why they included particular dinosaurs in their suborders and try to resolve any double listings. Of course, scientists can't agree on the suborders and neither do the students. This seems to enhance the importance of the activity as a thinking skill.

Maureen Barnhart, the fifth and sixth grade teacher who taught the dinosaur unit at All Saints, states, "The subject of dinosaurs lends itself to the higher-level thinking skills. It is a subject about which we can only gather evidence to speculate on what the world was really like. Students see the

scientists coming to different theories based on the facts and realize that they also may evaluate the evidence and come to different, but valid, theories."

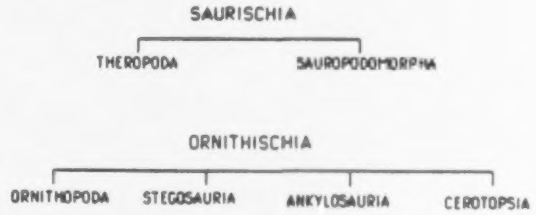
By now the students are ready to **synthesize** their dinosaur knowledge and create their own dinosaurs. In this activity students are told that they have found a dinosaur bone in their back yard. A handout includes a picture of the bone. They must decide what the dinosaur looked like, how big it was, when it lived, what order and suborder it belonged to (or they can create a new order or suborder), give the dinosaur a name, and then draw a picture of it, placing their fossil anywhere in the dinosaur. Although the outcomes must be consistent with the information they have about dinosaurs, creativity is encouraged and some weird dinosaurs are to be expected!

Another activity that encourages creative thinking also has students using word processing, data base and spreadsheet skills. One of the spreadsheets in the unit is a timeline that lists each of the 40 dinosaurs and places

Name____________________

Date____________________

CLASSIFICATION OF DINOSAURS



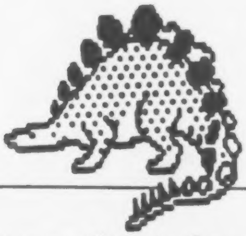
SAURISCHIA (sawr-ISS-kee-ah): lizard-like hips and clawed feet, some biped, some quadruped, some carnivore, some herbivore, some omnivores

Theropoda (thair-uh-PODE-ah): most carnivore, some omnivore, all biped with strong hind legs and body held horizontal

Sauropodomorpha (sawr-o-pod-ah-MORF-ah): all herbivore, all quadruped, all small head, huge body, long neck and long tail

Figure 2.

Student worksheet on classification.



File: OINOTIMELINE

DINOSAUR TIMELINE	DINOSAUR TIMELINE	DINOSAUR TIMELINE	DINOSAUR TIMELINE	DINOSAUR TIMELINE
140 Million Years Ago	130 Million Years Ago	120 Million Years Ago	110 Million Years Ago	100 Million Years Ago
Jurassic Period Large marine reptiles Warm, wet climate	Cretaceous Period	Cretaceous Period Rocky Mountains begin to rise	Cretaceous Period Most plants, invertebrate animals, fishes, and birds of modern types	Cretaceous Period Small and very primitive mammals
Compsognathus Ornitholestes Camptosaurus Megalosaurus	Iguanadon	Polacanthus	Hypsilophodon Spinosaurus	Corythosaurus Psittacosaurus Nodosaurus

Figure 3.

them in their time periods (see figure 3). The timeline also includes information about what other animals, climate, plants, etc., existed during that period. The students use this spreadsheet, along with the data base, to answer questions for a dinosaur that they have chosen. In the word processor, the answers are inserted into a story about a space traveler who is transported back into the dinosaur age. The students must also write an original ending to the story and then print it out.

Creative thinking and writing are also stressed in an activity that requires the students to use **evaluation** thinking skills. The students are given 13 reasons why dinosaurs may have become extinct. They then research them to defend one of these reasons or come up with a reason of their own. Next, they are asked to write a story on the word processor, using their research to back up their theory. Since this is a creative endeavor, any theory, as long as it is substantiated by some evidence, is acceptable.

Because it is unlikely that all the students can be using a computer at the same time, computer work can be supplemented with desk work that also encourages higher-level thinking. For example, math and logic, fossil research, graphing and interpreting graphs, Greek translations, and statistics are a few of the desk activities that encourage students to exercise their thinking skills. Figure 4 shows a sample of these worksheets.

Dinosaurs is just one subject area that is well suited for use with computer application programs. Although the objectives in this unit include learning about dinosaurs, developing computer and research skills, and much more, the top priority for the unit is the development of the students' higher-level thinking abilities.

[Sister Shirley Krueger, Computer Literacy Teacher, All Saints School, Portland, OR; Math Learning Center, P.O. Box 19567, Portland, OR 97219.]

Software

The Dinosaur Packet (96 pages of written activities and a data disk) using *AppleWorks* is available for $25 from the Math Learning Center, P.O. Box 3226, Salem, OR 97302; ph. 503/229-3041. A MECC *Dataquest Composer* version is available. Write for information.

DINOSAUR LOGIC 1

Sue was researching dinosaurs. She found the weights of five dinosaurs. Using the table and the clues below, find the correct weight of each dinosaur

1 The Iguanadon was not the heaviest dinosaur
2 The Brachiosaurus weighed more than the Brontosaurus
3 The Diplodocus weighed less than 60,000 pounds
4 The Brontosaurus weighed 80,000 pounds
5 The Iguanadon weighed more than the Stegosaurus but less than the Diplodocus
6 The Iguanadon weighed less than 25,000 pounds but more than 8,000 pounds

	8,000	10,000	50,000	80,000	160,000
Brontosaurus					
Diplodocus					
Brachiosaurus					
Iguanodon					
Stegosaurus					

1 The Brontosaurus weighed________________
2 The Diplodocus weighed________________
3 The Brachiosaurus weighed________________
4 The Iguanodon weighed________________
5 The Stegosaurus weighed________________

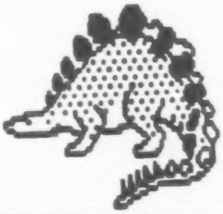


Figure 4.

Student worksheet from The Dinosaur Packet.

The Computing Teacher December/January 1987-1988

COMPUTERS IN THE SCIENCES

Edited by Richard Adams

Introduction

When you want *the* answer, you talk to an authority on the subject. Traditionally, classroom teachers have found themselves in the position of being that authority. Perhaps that made sense in the Middle Ages, and even in Industrial Age thinking. But in today's Information Age society, there is simply too much to know for teachers and citizens to keep current on everything. It makes sense to consult up-to-date references on the subject in question. More and more, databases are being accessed for current information, allowing the teacher to take the role of facilitator. Following are two different approaches to consulting a database as an authority on minerals.

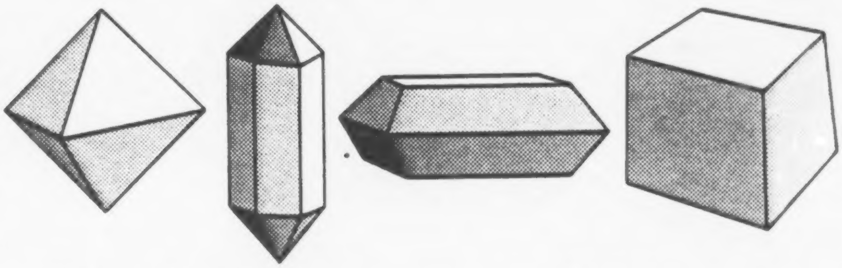
Minerals, which are the key to rock identification, have unique properties based on their crystalline structures. Through careful investigation and questioning, students can become adept at determining the identity of minerals based on their characteristic properties.

Janet Woerner has designed an *AppleWorks* database which contains 127 records of different minerals. Using Woerner's approach, students must first learn database skills—search and sort strategies, etc. (The time invested in learning these generic strategies will pay off later if a teacher is planning follow-up database activities.) The power available in *AppleWorks* and similar databases allows students to selectively print reports based on criteria they establish.

Jacob Hirschfelt has created a computerized mineral identification system using a database format. This program prompts students through a series of questions with options based on key properties of minerals. As students answer the questions for a given specimen, they systematically narrow the field of possibilities, finally identifying their particular mineral.

Both approaches presented may be modified for use with any other object, plant, or animal that we systematically classify.

—Richard Adams and Heidi Imhof



The Database as a Resource in the Earth Science Classroom

by
Janet J. Woerner

Every earth science textbook—including many elementary textbooks with earth science content—contains at least one chapter on the identification of rocks and minerals. This identification is usually done in a very traditional method which has been passed down from college to high school to middle school to elementary school. In this method, the properties of each mineral are presented to be memorized, and students may test these properties in the laboratory to verify the book.

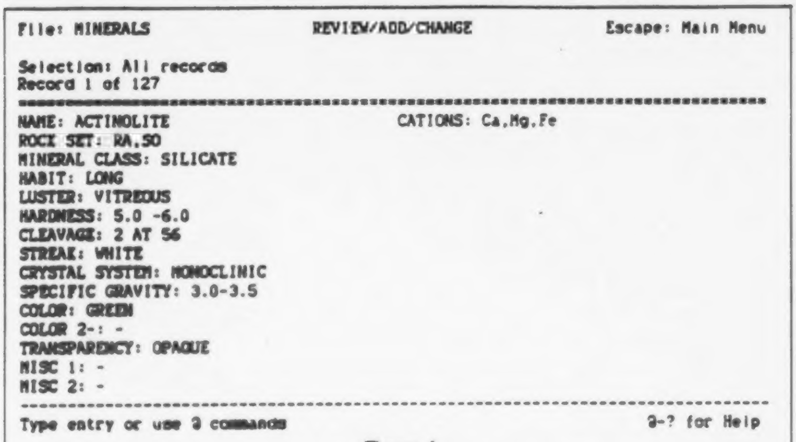
For example, calcite will react with hydrochloric acid (HCl) by bubbling and releasing carbon dioxide gas. Students are given a bit of calcite and some weak HCl and they observe the bubbling. They may be allowed to test a few other minerals to make sure that they don't also react to the acid. During the test over this material, students probably don't see any mineral samples or acid, but are simply asked a written question such as, "What is the mineral which reacts with HCl?"

In contrast, a great body of literature collected over many years espouses the use of "discovery" or "inquiry" learning in the science classroom (Wise, 1983). This approach encourages teaching science as a process, not simply the set of conclusions formed by previous generations of scientists.

Using the discovery method in learning to observe, classify and identify the earth's minerals, students actively use concepts which they themselves develop. Students generate their own concept label; define that concept; and identify the criterion attribute(s), relevant attributes, irrelevant attributes, examples and nonexamples. Further, students must identify relationships between two concepts such as metallic luster and specific gravity. Once that has been done, students can identify that mineral.

The computer is an excellent tool for the inquiry approach. Using the sort, find and arrange features of a database, students can quickly narrow down the possibilities for their samples. In addition, students learn which characteristics or attributes are most critical in the mineral's identification.

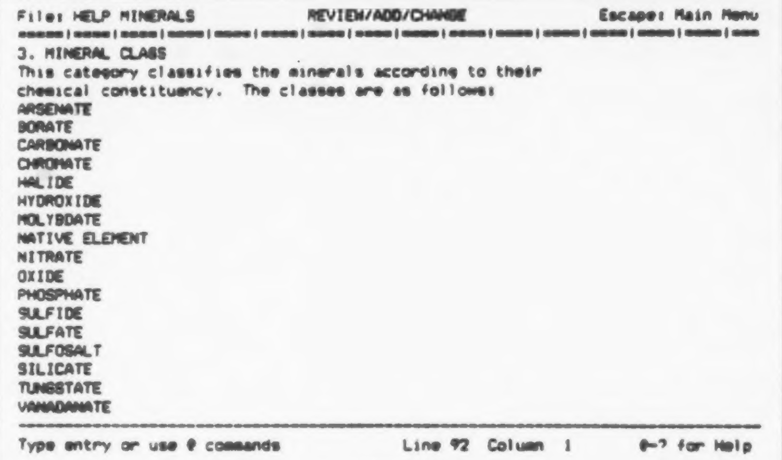
A minerals database file can be constructed by the teacher and/or students from illus-



```
File: MINERALS                 REVIEW/ADD/CHANGE              Escape: Main Menu

Selection: All records
Record 1 of 127
================================================================================
NAME: ACTINOLITE                              CATIONS: Ca,Mg,Fe
ROCK SET: RA,SO
MINERAL CLASS: SILICATE
HABIT: LONG
LUSTER: VITREOUS
HARDNESS: 5.0 -6.0
CLEAVAGE: 2 AT 56
STREAK: WHITE
CRYSTAL SYSTEM: MONOCLINIC
SPECIFIC GRAVITY: 3.0-3.5
COLOR: GREEN
COLOR 2-: -
TRANSPARENCY: OPAQUE
MISC 1: -
MISC 2: -
--------------------------------------------------------------------------------
Type entry or use ∂ commands                                       ∂-? for Help
```

Figure 1.



```
File: HELP MINERALS            REVIEW/ADD/CHANGE              Escape: Main Menu
=====|=====|=====|=====|=====|=====|=====|=====|=====|=====|=====|=====|=====|===
3. MINERAL CLASS
This category classifies the minerals according to their
chemical constituency.  The classes are as follows:
ARSENATE
BORATE
CARBONATE
CHROMATE
HALIDE
HYDROXIDE
MOLYBDATE
NATIVE ELEMENT
NITRATE
OXIDE
PHOSPHATE
SULFIDE
SULFATE
SULFOSALT
SILICATE
TUNGSTATE
VANADANATE
--------------------------------------------------------------------------------
Type entry or use ∂ commands              Line 92  Column  1        ∂-? for Help
```

Figure 2.

trations or keys in their textbook, a layman's guide to identification of minerals, or a university text. If you are planning to teach rocks, minerals and fossils, you will want to construct separate database files for each because the key criteria for identification are different.

The Minerals Database described here uses *AppleWorks* and contains 127 records. Each record contains 16 categories useful in identifying minerals (see figure 1). In the accompanying Help Minerals word processor file, the database file is explained, each category is defined, and each mineral property is explained. Properties such as habit, luster and mineral class are accompanied by lists of the choices within the database (see figure 2).

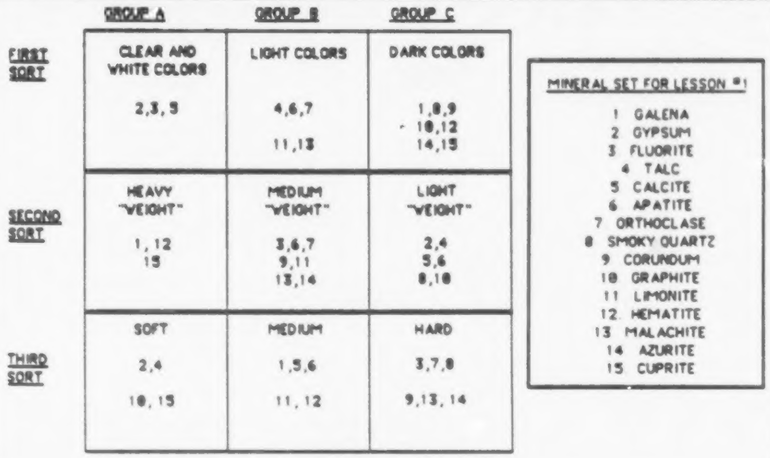
Students are provided with lessons on the properties of minerals as well as lessons in using the computer and accessing the database and word processor files. They are then given a set of mineral samples to identify by name. Students perform whatever tests they wish and use the database to find the name of the mineral. Additional information in the record of each mineral can be used to find out more about properties which were not tested.

In this manner, students take responsibility for setting up their own investigations, collecting and analyzing their own data, and learning to use a tool which is applicable in other classes and in the world outside the classroom.

An outline of the series of lessons I developed follows. Detailed instructions are given within the actual lessons for computer use, from booting the disk to choosing from the main menu, making this series of lessons appropriate for teachers and students new to computers. More experienced users can move immediately to the Minerals Database activities. (The entire lesson series and the database are available from me at the address below.)

Lesson 1

In the first lesson, students work off computer to group a set of 12 to 15 numbered mineral samples into three separate categories based on some property or characteristic that they observe. They create a table listing the property they used to separate the minerals and the numbers of the minerals that fall into each group. They repeat the process two more times from the beginning, using a different characteristic for each sort they do. The table they develop might look something like that in figure 3. Students share their results with others in the class then test each other by describing a mineral sample to the class, using the characteristics they used in their sort process, and asking other students to identify the sample. Finally, all sort characteristics

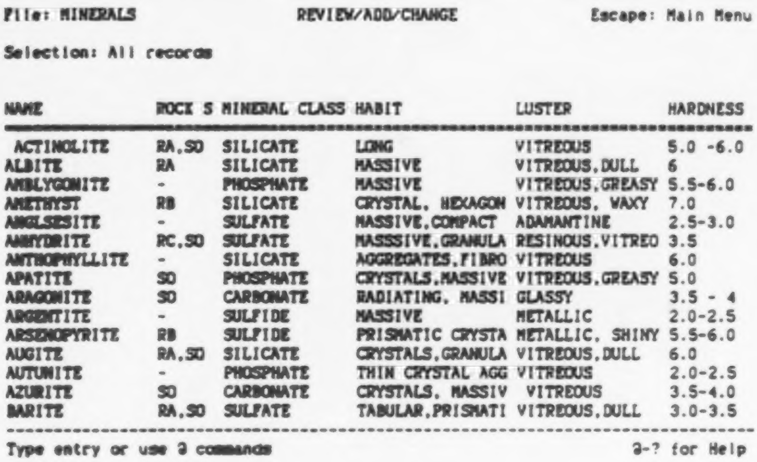


	GROUP A	GROUP B	GROUP C
FIRST SORT	CLEAR AND WHITE COLORS 2,3,5	LIGHT COLORS 4,6,7 11,13	DARK COLORS 1,8,9 10,12 14,15
SECOND SORT	HEAVY "WEIGHT" 1, 12 15	MEDIUM "WEIGHT" 3,6,7 9,11 13,14	LIGHT "WEIGHT" 2,4 5,6 8,10
THIRD SORT	SOFT 2,4 10, 15	MEDIUM 1,5,6 11, 12	HARD 3,7,8 9,13, 14

MINERAL SET FOR LESSON #1

1	GALENA
2	GYPSUM
3	FLUORITE
4	TALC
5	CALCITE
6	APATITE
7	ORTHOCLASE
8	SMOKY QUARTZ
9	CORUNDUM
10	GRAPHITE
11	LIMONITE
12.	HEMATITE
13	MALACHITE
14	AZURITE
15	CUPRITE

Figure 3.



```
File: MINERALS                    REVIEW/ADD/CHANGE                 Escape: Main Menu

Selection: All records

NAME             ROCK S MINERAL CLASS HABIT              LUSTER            HARDNESS
===================================================================================
 ACTINOLITE      RA,SO  SILICATE      LONG               VITREOUS          5.0 -6.0
ALBITE           RA     SILICATE      MASSIVE            VITREOUS,DULL     6
AMBLYGONITE      -      PHOSPHATE     MASSIVE            VITREOUS,GREASY   5.5-6.0
AMETHYST         RB     SILICATE      CRYSTAL, HEXAGON   VITREOUS, WAXY    7.0
ANGLSESITE       -      SULFATE       MASSIVE,COMPACT    ADAMANTINE        2.5-3.0
ANHYDRITE        RC,SO  SULFATE       MASSSIVE,GRANULA   RESINOUS,VITREO   3.5
ANTHOPHYLLITE    -      SILICATE      AGGREGATES,FIBRO   VITREOUS          6.0
APATITE          SO     PHOSPHATE     CRYSTALS,MASSIVE   VITREOUS,GREASY   5.0
ARAGONITE        SO     CARBONATE     RADIATING, MASSI   GLASSY            3.5 - 4
ARGENTITE        -      SULFIDE       MASSIVE            METALLIC          2.0-2.5
ARSENOPYRITE     RB     SULFIDE       PRISMATIC CRYSTA   METALLIC, SHINY   5.5-6.0
AUGITE           RA,SO  SILICATE      CRYSTALS,GRANULA   VITREOUS,DULL     6.0
AUTUNITE         -      PHOSPHATE     THIN CRYSTAL AGG   VITREOUS          2.0-2.5
AZURITE          SO     CARBONATE     CRYSTALS, MASSIV    VITREOUS         3.5-4.0
BARITE           RA,SO  SULFATE       TABULAR,PRISMATI   VITREOUS,DULL     3.0-3.5
-----------------------------------------------------------------------------------
Type entry or use @ commands                                           @-? for Help
```

Figure 4.

students have used are listed on the chalkboard, and students try to develop broad categories that fit the schemes used by several students. For example, if students used red, white and brown to describe their samples during one sort, color would be the broad category.

Lesson 2

In the second lesson, students learn to conduct standard tests on samples of minerals in order to determine characteristic properties of the samples. Using methods outlined in their earth science text, students learn how to test samples for the following properties:

1. Color of mineral
2. Color of streak
3. Hardness, using Mohs scale.
4. Specific gravity
5. Reaction to HCl
6. Is it a natural magnet? Does it attract a magnet?
7. Relative transparency
8. Crystal form or shape
9. Cleavage and/or fracture
10. Luster

Lesson 3

In the third lesson, students first work with the word processing file Help Minerals and then access information within the Minerals Database. Then students work on problems which guide them through the use of the database. For example, they sort metallic minerals with hardness greater than 2.5. They continue to explore the environment, trying metallic minerals with a hardness of less than 5.5. They learn to select all records to see all the entries and categories. A partial printing of such a report is shown in figure 4.

Lesson 4

In the final lesson, students are given unknown mineral samples and are asked to determine their identities based on characteristic properties they observe, using the database.

Obtaining Materials

The *AppleWorks* database is keyed to sets of minerals which are available from Educator's Supply (P.O. Box 503, Lee's Summit, MO 64063), which maintains supplies of good representative minerals and rocks at competitive prices. The sets are called *Rocky Sets A, B, and C.* The database also contains all of those minerals which might be used in competition at your state or national Science Olympiad. The Science Olympiad set, also from Educator's Supply, contains rocks, minerals and fossils.

Additional information on the teaching of earth science at the precollege level can be obtained from the National Earth Science Teacher's Association (Department of Geological Sciences, Michigan State University, East Lansing, MI 48824). The mineral lessons, database and word processing file described are available on disk by sending a self-addressed manila envelope, a blank 5¼-inch floppy disk and $1 to me at the address below.

[Janet Woerner, Division of Education, Indiana University Northwest, Gary, IN 46408.]

Reference

Wise, Kevin C. and James R. Okey. A Meta-Analysis of the Effects of Various Science Teaching Strategies on Achievement. *Journal of Research in Science Teaching.* Vol. 20, No. 5, pp. 419-435. 1983.

The Student-Designed Database

by
Rick Thomas

Learning to use an electronic data file is becoming a fact of life for many secondary students. Whether they learn its use on the job (so to speak) in their social studies or science classes or they are exposed to this tool in a computer literacy class, the skills associated with electronically finding, selecting, and organizing data are becoming a part of the common curriculum. Hunter (1985) has suggested a three-stage model for learning to effectively use a database program:

- Using data files;
- Building files; and
- Designing files.

Much of the database course materials available today are in stage one, requiring use of existing data files. In addition to promoting knowledge of content, recent research (White, 1987) suggests that the use of data files in this manner does in fact support the development of important problem solving skills including identifying necessary and sufficient information and formulating alternative organizations of data.

Building files takes students to the stage of locating appropriate sources of information and organizing and entering data into the computer. Courseware such as *GeoWorld* (Snyder, 1987) give students this experience. The program provides a structure for the data involved and a basic set of information which students are required to extend as part of the simulation. (See *TCT* November 1987, for a review of *GeoWorld*.)

Hunter's third stage, designing files, is conceptually the most difficult. It incorporates using and extending files as well as requiring that students ask questions that shape the initial organization of the file and the selection of data. The material that follows, from *ClassWorks: AppleWorks for the Classroom*, newly published by ICCE, offers an extended example of this process and suggestions for classroom use.

For the following lesson, I suggest working in a large group format. Depending on the ability level of your class, a project such as this may prove too difficult for small groups. Middle school teachers have indicated success with advanced eighth graders working in small groups. Average ability high school juniors and seniors are able to implement their own projects, although the exchange of ideas provided by groups is preferable.

Number of Class Periods: 10-14

Creating and using a database generally consists of the following steps:

1) Identifying a problem;
2) Brainstorming questions related to the problem;
3) Identifying the specific information and possible sources needed to answer each of the questions;
4) Analyzing the scope of the problem and the appropriateness of using a computer to explore it;
5) Prioritizing the questions and selecting those which will be studied;
6) Clarifying and eliminating duplicate categories of information;
7) Identifying the key, or most significant, category;
8) Arranging information by categories in a table;
9) Modifying categories and the organization of information as needed so that you can answer your questions (this may involve repeating all or some of steps 2 through 8);
10) Doing the research to gather the necessary information;
11) Creating the computer version of the database and entering the data, supplementing it with other sources as needed;
12) Asking your questions in the form allowed by the database program you are using, developing and testing hypotheses, and drawing conclusions; and
13) Summarizing your work and conclusions in a report.

Only a few of these steps (11 and 12, and perhaps 13 if a word processor is used), require the use of a computer. Otherwise, the process of creating a database is a conceptual activity akin to composition.

AN EXAMPLE

Modeling the creation of a database as a large group activity with the active participation of an entire class is an effective way of introducing the process outlined above. The following example is one suggestion. It is important to remember, though, that the activity will have the greatest impact if the problem selected is one in which you and your class share an interest.

1) Identify the problem

Prime time commercial television seems to be dominated by a limited variety of different types of shows.

2) Brainstorm related questions

Depending on the number of questions, this activity may take a considerable amount of room. You will need ample board space or butcher paper on which questions can be recorded. Leave room beneath each question to expand your outline in the next step.

a) What types of shows are aired?

b) How do the different networks compare in terms of the types of shows they present?

c) Is there a relationship between types of shows and the tastes of different age groups?

d) Is there a relationship between the type of show and the time it is shown?

e) Do different advertisers tend to purchase time on different types of shows?

f) Are different types of products associated with different types of shows?

etc.

3) Identify kinds of information needed and sources

a) A list of class-developed categories of types of shows (e.g., situation comedies, sports, movies, soaps, drama) and a matching list of criteria for classifying shows in each category;

b) A list of shows classified by network and type (use *TV Guide* and your list of categories and criteria);

c) A list of shows classified by the age group at which each is aimed (use results of a class survey of different age groups and their viewing preferences);

d) A list of shows classified by time shown (use *TV Guide*);

e) A list of advertisers for each show (summary of one or two weeks' viewing and tallying of advertisers);

f) A list of class-developed categories for classifying types of products (e.g., food, beverages, cleaning products, movies, personal care products) and criteria for classifying in each category;

g) A list of advertisers for each show by type of product (class summary of advertisers and classification scheme);

etc.

4) Analyzing the scope of the problem

There are basically two questions to answer here: 1) Is the computer an appropriate tool to use in analyzing the problem the way it has been defined? And 2) Is the software adequate to manage the amount of information that will be collected? Not every program can handle every application. For example, *AppleWorks*, used with a 128K Apple II, is not suitable for maintaining an inventory of even a small store. (There is a limit of approximately 750 records unless extra memory is added to the computer.) It is important for students to realize that a computerized database, despite its novelty, is not the only means of organizing and communicating the information with which they are working.

The data that will be required to explore the television problem seems to satisfy both conditions that suggest database use: The information is not easily accessible in any one source, and there is not an overwhelming amount.

5) Prioritizing questions

The task of prioritizing questions clearly establishes the tone and perspective of the project. Choosing to emphasize the role of advertisers in the present case, for example, would cast the data in a different light than would focusing on age group preferences. The task is analogous to the process of outlining an essay and identifying a thesis statement and those arguments which best support it. The nice thing about an electronic database, though, is that it is dynamic. The priorities you establish now are not carved in stone. The tool allows you the flexibility of examining the data under a different organization later.

Questions from step 2 in order of significance for this example:

a, f, e, b, c, d

6) Clarifying categories of information

It is now possible to define specific categories of information based on the significance that has been attached to each of the questions.

Category	Definition
Show	• title
Type	• based on class list of categories and criteria
Principal Advertiser	• "This show brought to you by. . . ."
Type of Product	• based on class list of categories and criteria
Network	• ABC, NBC, CBS
Target Audience	• based on class age-group definitions and survey
Broadcast Time	• prime time (8:00-11:00 PM)

7) Key category

Identify the focus of information in the database—in this case the name of each show.

8) Table

Show	Type	Principal Advertiser	Type of Product	Network	Target Audience	Broadcast Time
Magnum						
Cheers						
Cosby						
etc.						

9) Testing your organization

Students may experience difficulty at this point if they fail to keep in mind the questions they want answered as they categorize the available information. You need to ask whether or not the structure imposed on the data supports answering the types of questions raised. Now is the time to test the organization by posing the questions, identifying appropriate database operations, and checking their feasibility against the categories defined.

For example:

How do the different networks compare in terms of the different types of shows they present?

Selection Rule: Network equals (each network)

Arrange by: Type

This question can be answered, but you may decide after review that certain questions *cannot* be answered because of limitations in the organization of the data or in the database program itself. Careful review can save considerable effort in collecting data in either case.

10) Research

Collecting the information necessary for this example will clearly benefit from a division of labor. Teams should be assigned the projects of developing survey questions and classification schemes for shows and advertising products and then conducting the surveys. Cards need to be prepared for collecting data on individual shows. Individuals must then be assigned the task of watching specific shows.

Students are particularly susceptible to two problems involved in the research process:

a) *Lack of Objectivity*—Preconceptions have a way of sneaking into work. The way in which survey questions are posed, for example, may influence answers. It is important that work be reviewed with this possibility in mind.

b) *Poor Sampling*—Generalizations apply only to the sample from which data is fairly drawn. You need to question how representative the sample is of the population involved and whether or not a random process is planned to collect data.

11) Creating the computer version of the database

Now that all of the data is collected, it is ready to be incorporated in a file using database management software. Have students practice these steps. Each pair of students creates its own version of the class file and then goes from computer to computer entering a small part of the data.

12) Using the database

Students now have the opportunity to use the database file to answer the questions that were raised initially. There is also the opportunity for a good deal more learning about the process of conducting research. Raise the following types of questions as students work with the file:

- Is there sufficient information?
- What other types of information might have been included?
- Is the information objective? Can you see the opinions of your class reflected in the data?
- Do you think that if you followed the same process again in collecting your data the results would be the same?
- Now that you have worked with the data, have you discovered any new or unexpected relationships? If you have, how can you test them?

13) Reporting results

Reporting the results of the project should provide the opportunity to draw conclusions and to reflect on the process. Students should be asked to identify problems with the way in which the project was carried out and to suggest improvements.

POSSIBLE PROJECTS

- The content of popular music and videos. (A project suggested by students during Congressional hearings on violence in rock music.)
- Middle school social groups. (A file developed on the basis of surveys of individual middle school students.)
- Newspaper customers. (A file developed by an individual high school student to help manage his paper route. This project was implemented on a spatial database and included a map component in each record.)
- College reference guide. (A group of seniors identified and collected information important to them in selecting a college.)
- Advertising appeal. (A file categorizing advertisements on the basis of what and whom they appealed to.)

As a teacher, you may find yourself threatened by the degree to which students control the development of the suggested project. You need not be. One of the more exciting aspects of working with computers and this type of project is the group dynamics. Students get enthused about their own questions and about thinking through ways in which they can be answered. They eagerly help one another debug the database development process to make their project work. In the end, they will have learned more from their mistakes and from their results, however imperfect they may be, than from a more traditional expository treatment of the subject.

Do students benefit from the experience of designing, extending, and using their own electronic data files? There is no hard research evidence at this time that they do. However, my personal experience with several of the projects described above and the reports of other teachers suggests an emphatic "Yes! The experience is worthwhile." Students learn that the shape of the question is as important as the answer. They learn about the limitations of the tool. They learn to be supportive and constructively critical of one another's work. They learn to examine both questions and answers in light of their own biases and habits. And, perhaps most important in view of the glut of information we all face, students learn that they can organize large amounts of data in a systematic fashion and derive meaning from it. So students (and their teachers) benefit from designing and implementing their own electronic data files. The experience should be part of learning to use the tool effectively.

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Editor's Note: This article is reprinted from ClassWorks: AppleWorks for the Classroom, *a new booklet published by ICCE. For ordering information, see the ad on page 1 of this issue.*

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Problem Solving with Data Bases

by
Beverly Hunter

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Lynn and Joey have been learning in history class about Ben Franklin's experiments with electricity. Their teacher has challenged them to find out some of the earliest inventions that used electricity.

"Let's find all the inventions made before 1900," Joey says.

"Too many," replies Lynn.

"Let's find all inventions made before 1900 that used electricity," Joey suggests.

"Yeah. But there might be a lot of them. Let's print a list."

"OK. Just print names of the inventions."

"No. We need dates to know the *earliest* inventions."

"Let's print the dates and sort them by year. Then the earliest inventions will be at the top of the list."

This problem-solving session soon produces a printed list of inventions similar to that shown in figure 1. Lynn and Joey have been using a data management program and a file of information on the subject of inventions. They use the information in the file to solve problems, identify historical trends and relationships, test hypotheses, and learn some techniques for managing information stored in computer-readable form.

> ***"The same data management program can be used to create and use files on subjects as diverse as fish, student grades, cafeteria menus, countries of the world, poets, pets or paper route customers."***

What Is a Data Management Program?

The terms "data management program," "data base management system," "filing system" and "file management program" are all used to denote computer programs that enable you to design, build and use collections of information. These collections of information are called files, data files or data bases.

A file or data base is an organized collection of information on a particular subject. A telephone book, a collection of report cards, a class roster, a table of population statistics in an almanac, a library card catalog—these are all familiar kinds of files or data bases we all work with every day on paper. But these are static files—you have no control over the way in which the data are organized. Imagine trying to find all the hardware stores in your town just by using the white pages of the phone book.

A data management program makes it easy for you to use a personal computer to store, update, organize and retrieve information from data files. An important characteristic of such programs is that they are *general-purpose* tools. The same program can be used to create and use files on subjects as diverse as fish, student grades, cafeteria menus, countries of the world, poets, pets or paper route customers.

```
INVENTIONS USING ELECTRICITY

Lightning Rod  1752
Benjamin Franklin

Electric Battery  1796
Alessandro Volta

Electromagnet  1824
Joseph Henry

Morse Code  1837
Samuel Morse

Telegraph  1844
Samuel Morse

Electric Vote Counter  1868
Thomas A. Edison

Stock Ticker  1869
Thomas A. Edison

Telephone  1876
Alexander Graham Bell

Microphone  1878
Thomas A. Edison

Incandescent Lamp (Light Bulb)  1879
Thomas A. Edison

Tabulating Machine  1884
Herman Hollerith

Radio  1896
Guglielmo Marconi
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Figure 1.
Lynn and Joey's printout of inventions before 1900 that depended on electricity, sorted by year of invention.

BEST COPY AVAILABLE

All the records in one file have the same fields. The NAME of the invention, the YEAR, a TYPE descriptor, a brief paragraph DESCRIPTION of the invention, a paragraph telling the IMPACT of that invention, etc., are included for every invention in the Inventions file.

Figure 3 shows part of a record (form) for the Election file. The actual form has four times this much information in it. Data for each presidential election year since 1789 is on a separate form. The Election file is designed to encourage students to investigate trends in voter participation, development of political parties, campaign financing, campaign issues and congressional elections.

The Common Substances file (figure 4 shows part of a sample form) is designed to encourage children to investigate and become familiar with properties (such as melting point, density, color, etc.) of common substances such as ammonia, brass, chalk, coal, concrete, ice, iron, paper, sugar or wood. They use the file to solve problems such as, "Which kinds of wood will sink in alcohol, but float in water?"

PROPERTIES OF COMMON SUBSTANCES

COMMON NAME: Iron
ELEMENT, COMPOUND, OR MIXTURE: Element
DENSITY (XX.XXXX): 07.8600 (g/ml)
BOILING PT.—C (XXXX.XX): 2750.00
MELTING PT.—C (XXXX.XX): 1535.00
COLOR: Gray
ODOR: Odorless
SOLVENT (OTHER THAN WATER): Acids
SOLUBILITY IN COLD WATER—G/L (XX.XXX): Insoluble

Figure 4.
Part of the Common Substance file record for iron.

Figure 5 shows part of a sample form on the subject of animals. The Animals file is designed to encourage students to explore many different characteristics of animals—to compare and contrast similarities and differences among animals of different classes, habitats, size or food type. Students can, of course, add more animals to the file. At the present time there are 135 animals in the file covering eight classifications, with about 40 different data items for each animal. This file takes up about 60 percent of the capacity of one Apple II floppy disk.

ANIMALS

COMMON NAME: Horse
CLASS: Mammalia
SCIENTIFIC NAME: Equus caballus
WEIGHT IN KG. (XXXXXX.XX): 000453.92
LIFE SPAN IN YRS. (XXX): 035
HABITAT: Terrestrial
BIOME: Domestic
INTEGUMENT: Hair
ACTIVE ALL YEAR (Y/N): Yes
LOCOMOTION: Walking

Figure 5.
Part of the Animals file record for horse.

Stages of Learning with Data Bases

Students can develop their data management skills in three prospective stages:

Stage 1: **USING**	Students use data files that have been created by someone else, e.g., the files shown in figures 2-5. They use the data to test hypotheses, discover relationships, identify commonalities, look for trends, help solve problems, organize reports or investigate new subjects.
Stage 2: **BUILDING**	Students build a file designed for them; that is, they are provided with a form or record that has already been designed and tested by the teacher or someone else. Such a blank form is sometimes called a ***template***. With the teacher's help, students plan the research, identify sources of information, gather data, check it for accuracy, enter the data into the computer, and then use the file in their studies.
Stage 3: **DESIGNING**	Students plan, design, build and use their own data files.

This progression is suggested because when you *use* a variety of data files you learn many concepts and skills that are useful later in building files. For example, recall the TYPE data item in the Inventions file. Through experience in using TYPE to retrieve information about selected types of inventions, students learn the importance of using standardized descriptors for their data. For example, if you want to look at all the Agriculture inventions, you don't want a mixture of "farming," "farms," "agriculture" and "food-growing" descriptors in the file. This concept is essential when students gather data to build their own files, because they must set up and apply a standard way of describing things for their own data bases.

Similarly, when you **build** files you learn concepts and skills needed in designing files. For example, when students gather the data for their own file they discover that different reference sources provide data in different forms. One science book might give temperature information in centigrade units, for example, while another might give the same information in Fahrenheit. Or one reference book might give populations in millions, while another provides them in hundred thousands. When designing a file, you need to first find out the form of your source data.

STAGE 1: USING DATA FILES

The following sample activities illustrate a sequence in which students become increasingly more proficient in their use of a data file, as well as becoming increasingly more familiar with a particular subject they're studying in history class. The example activities are based on the Inventions file mentioned earlier. Students use this file with the data management program called *PFS:FILE* (Software Publishing Company). However, the instructional purposes and scope and sequence of activities are applicable to the use of any data management program suitable for children.

Activity 1: Exploring a Data Base

When students (or people in general) start to use a data file that is new to them, the first thing they need to do is to explore the file—to discover what data are in the file and how the data are organized. This is similar to the way you might flip through a new textbook to see what topics are covered and how the material is organized. The specific techniques for doing this exploring on the computer depend on the data management software program you are using, how familiar the students already are with the subject matter, and how familiar the students already are with the data management program.

Activity 1 assumes students know very little about the subject matter and nothing about how to use the data management program. Students are taught to *browse* through a data base that is new to them. As they browse, point out various features of the data base, and have them take notes on certain facts and ideas that they notice. For example, the Inventions file has a data item called TYPE—have students take notes on the different TYPEs of inventions they see as they browse (agriculture, textiles, communications, etc.).

During this "exploring" activity, explain any new terms and concepts. For example, the Inventions file (figure 2) contains a data item called ENABLING TECHNOLOGY. It can be explained in this way: When a person invents something, s/he depends on other existing inventions. For example, you couldn't invent a wagon if wheels hadn't already been invented. The fact that you already have wheels ***enables*** you to invent the wagon. Wheels are an "enabling technology" for the invention of the wagon.

This exploring activity can be introduced in different ways. One way is for the teacher to demonstrate the exploration to the whole class or a small group. Throughout the demonstration there can be class discussion to ensure that all students understand the concepts and terms used in the file. Another way is to have students work in pairs at the computer. Prepared written lessons may be helpful for students to follow as they do their exploring on the computer. As they go through the lessons they can be instructed to take notes on some of their observations.

Activity 2: Asking Questions

After students are somewhat familiar with the content and organization of the data file, teach them how to use the data and the data management program to answer questions. The exact details depend upon the particular data management program used, and the way the particular data file is organized.

Begin by asking a question you're pretty sure students are familiar with, or have already been studying in class. For example, using the Inventions file, you can begin by asking students to discover Thomas Edison's inventions. Using the *PFS:FILE* program this is a very simple task: With the blank form on the screen, you simply type "..Edison" beside INVENTOR:. The .. before Edison is a way of avoiding the question of how to spell his first name or whether he has a middle initial. As soon as you type "..Edison" and press a key that tells the program to continue, one of Edison's inventions appears on the screen.

As this activity continues, ask progressively more sophisticated questions; that is, questions that require either more complex retrieval techniques or more complex interpretations from the data. For example, help students to narrow their search to focus on important inventions in the textile industry in the 18th century. (Find all textile TYPE inventions invented between 1700 and 1800.)

Above all, encourage students to experiment, to try things out, to discover limitations of the data base, to find questions that will stump their partner.

> ***"There are some advantages to having only one or two computers available for the class—students waiting to use the computer have more time to plan and document their approach to solving the problem."***

Activity 3: Defining Your Information Needs

After students are familiar with the data base and know how to retrieve selected information from it, they can learn to apply these skills in solving problems. The purpose of Activity 3 is to get students to define the information they will need in order to answer a question or solve a problem. Try to word the problem statement in such a manner that there is no single "right" way to go about solving it. For example, students might be asked to identify a single invention or group of inventions that make possible today's instantaneous worldwide communications capabilities, and to provide data to support their argument. There are many ways to go about analyzing this question using the Inventions data base. Some students may use the information on impact of inventions, while others may look for enabling technologies that are common to many recent communications inventions.

Encourage students to break the problem down into smaller problems or questions, and write the questions in their own words.

Students can work in pairs at their desks as they plan the information needed to answer the question. There are some advantages to having only one or two computers available for the class—students waiting to use the computer have more time to plan and document their approach to solving the problem.

Worksheets are beneficial in helping students plan the information they will get from the file to help answer the question or solve the problem. They need to decide how they will search for the particular data needed, what data items from the file should be printed out, what order the list of data should be printed in, and other details about the formatting of the list.

After students have planned their printouts, they can go to the computer and use the data management program to get the data they have planned.

Activity 4: Interpreting and Debugging

Whether you're a fifth grader studying history, an economist working for the Federal Reserve Board, or a businessperson making a business decision, ***you never get exactly the right information you need to solve a problem in your first attempt.*** In Activity 4, students examine the printout of information they have obtained to analyze how well it helps them answer their question or solve their problem.

> ***"Whether you're a fifth grader studying history or an economist working for the Federal Reserve Board, you never get exactly the right information you need to solve a problem in your first attempt."***

Figure 6 shows one student's first attempt at getting a printout of information to help answer the question about communications inventions. It very nicely lists communications inventions in order by year. However, it doesn't provide the information needed on either the impact of the inventions or the enabling technologies. The student minimally needs the information about the IMPACT: of the invention in order to understand how a particular invention affected our ability to communicate.

Again students can work in pairs at their desks, interpreting their printouts and trying to use the information to answer their questions. Usually they need to go back and get at least one more printout before they have what they need. Figure 7 shows a second attempt, this time including the information about impact of the inventions.

Encourage students to continue analyzing their printouts and gathering more information until they are able to interpret the data in a way that enables them to answer the question or refine their original hypothesis.

Activity 5: Updating the File

A wonderful characteristic of computerized data files is their updatability. Unlike a textbook, reference book or other printed material, a computer data file is very easily modified to suit your particular needs. For example, suppose you want your students to learn more about inventions related to use of energy sources such as coal, oil, solar, wind or atomic energy. Students can research inventions such as the waterwheel, turbine generator, windmill, solar furnace, nuclear reactor, etc. Each pair of students can gather information on one invention and add the data to the Inventions file. The whole class then has a richer collection of information on energy-related inventions to use in their studies.

Activity 6: Projects

After students have been led step-by-step through the first five activities, they should be ready to proceed on their own to use the file for a project. Ideally their project will result in a useful product for other students, the school or neighborhood community. Here are some example student projects using the Inventions file:

1. Prepare a chronological list of inventions in a subject area such as Information Processing or Agriculture. Show the enabling technology for the inventions on your printout. Analyze the relationships between the enabling technologies and the inventions they made possible.
2. Impact of inventions. Prepare a chronological list of inventions of a particular TYPE such as home/leisure or transportation. Include in your list the IMPACT data. Then interview some older people (the older the better), and ask them for their opinion as to how these inventions changed their lives or the lives of others. Can you summarize this information by selecting three inventions that have had the greatest impact on people or society?
3. Inventors. Prepare a list of inventors, grouped by nationality. Do you see any patterns in the types of inventions made by people from a certain nation? Do you see any patterns in the dates of the inventions that came from certain countries?
4. The effects of war. Find out the years of wars such as World War I or World War II. Look at the inventions made during those periods. Did the wars affect the kinds of inventions made?
5. Clustering of inventions. Examine a chronological list of inventions. Do you see any periods of time when there were a lot of inventions or a collection of related inventions? Find out more about those periods of history and see whether you can find a reason for this. Is it related to the enabling technology that was present?

```
             COMMUNICATIONS INVENTIONS
YEAR         INVENTION
0105         Paper
1450         Printing Press
1796         Electric Battery
1824         Electromagnet
1826         Braille
             Photography
1837         Morse Code
1844         Telegraph
1867         Typewriter
1868         Electric Vote Counter
1869         Stock Ticker
1876         Telephone
1878         Microphone
1894         Motion Pictures
1896         Radio
1904         Vacuum Tube
1923         Television
1937         Xerography
1948         Transistor
1956         Videotape Recorder
1962         Satellite Communications
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Figure 6.
Student's first attempt at getting information to answer the communications question.

6. Prepare a list of inventions that improved travel by land. What is the most recent invention in the file related to land travel?
7. Trace the development of guns over time. What was the first gun invented and when? Show that guns have become more powerful over time.
8. Many inventions became possible only after people learned how to turn oil into products such as gasoline and diesel fuel. Which inventions depended on oil refining and when were they invented?
9. What inventions contributed to the early Industrial Revolution in England in the 18th century?
10. In what ways did the invention of the steam engine and the refrigerator change the ways we prepare, distribute and use food?

COMMUNICATIONS INVENTIONS

YEAR	INVENTION	IMPACT
1876	Telephone	Allowed for a global network to convey sound. Local, long-distance and overseas telephones reach 96% of the places in the world.
1878	Microphone	The microphone is the foundation for much of the audio communication field. It is still used widely today.
1894	Motion Pictures	After refinements, led to the motion picture or movie industry.
1896	Radio	Made it possible for the first time to communicate a message instantly to thousands or millions of people at the same time, over long distances.
1904	Vacuum Tube	The vacuum tube was the foundation for electronics for 40 years. It has been almost completely replaced by the transistor, except in certain special-purpose applications, such as picture tubes in TVs.
1923	Television	Made it possible for the first time to communicate pictures and scenes to thousands or millions of people. Most effective means of communication ever devised—"the eyes and ears of the world." Force for education, enculturation, political persuasion and merchandising.
1937	Xerography	First xerographic copier was marketed by the Xerox Corporation in 1960 and has since grown at an astonishing rate. Completely replaced the need for retyping a document, thus saving time and labor.
1948	Transistor	It has supplanted the vacuum tube in electronic equipment. Transistors are used in radios, TVs, computers, hearing aids, etc. They revolutionized the development of the computer.
1956	Videotape Recorder	Provides good storage of program material and an advantage over film. Used extensively to tape programs for rebroadcasting later. Also used for instant replay.
1962	Satellite Communications	Communication satellites provide a major part of the world's global communications. They allow instantaneous transmittal of information and pictures.

Figure 7.
Second attempt at getting communications information.

STAGE 2: BUILDING FILES

After students know how to use data files, they will want to learn how to create their own. When students build their own files, they learn and apply skills such as:

- Analyzing the problem to be researched
- Planning their research
- Locating sources of data
- Gathering data
- Categorizing events
- Ensuring accuracy of data
- Organizing data
- Entering data into a computer

Creating files can be a class project, where each student or pair of students gathers and enters some of the data into the computer file. The end result is a file that everyone can use.

Examples of Files Students Have Built

- **American Presidents**
  Ten pairs of students each do library research on four U.S. presidents. They gather the data, organize it on paper, check each other's work for accuracy, key the data into the computer, and before they know it the whole class has created a complete data base of information on presidents. The information is then all there, in an organized and accessible form, for anyone to use in future writing assignments.
- **Local History**
  Students gather information from community members, local libraries and historical societies, and create an organized reference source on the history of their own town or city's events, places and people. Some classes donate their files to the local library for others to use and update.
- **Community Service**
  Students help local community service agencies by creating files of information about their services, service areas, resources, who they serve, how to contact them, and other needed information.
- **Countries of the World**
  Four sixth grade classes each choose a continent and build a file of data on each country in their continent. The file can be used to compare countries and continents in terms of factors such as natural resources, education levels, and per capita income.
- **Science Labs**
  Students organize and interpret the results of their laboratory experiments by building and using data files. They compare findings by having all students' results in the same file format.

STAGE 3: DESIGNING FILES

Since the design of a file must take into account how the file will be used and how the original data will be gathered, students' experiences in Stages 1 and 2 provide them with important enabling skills for Stage 3.

When students work together in small groups to design their own files, they develop and apply skills involved in:

- Project planning and small-group decision making;
- Problem analysis and interviewing;
- File design, including content, format, screen layout, etc.;
- Testing, debugging and revising;

- Data gathering and data entry; and
- Using files.

How to Select Data Management Tools for the Classroom

There are hundreds of different data management programs available on the market for most personal computers. Better ones are being created every day. Here are some of the characteristics to look for in choosing a data management tool for students to use in science, social studies, language arts and other school curriculum areas:

1. **Ease of learning.** It is important that teachers and students be able to concentrate on the subject at hand and can manage their own information. The technical details of using the program shouldn't get in the way. A teacher who is concerned about teaching history doesn't want to spend two weeks teaching how to use the software before students can access the history information. Students should be able to begin retrieving selected information from a file after just a few minutes' orientation to the software and the data file.

2. **Ease of use.** Students shouldn't have to memorize a lot of computer commands or wade through complicated menu sequences. Be willing to give up some fancy features in exchange for simplicity of operation.

3. **Flexible formats for data.** Teachers and students need to be able to experiment with many different kinds of data files for many different purposes. The example files shown in figures 2-5 are quite different. Some have a lot of text, while others are primarily statistical data. The program should be flexible in accepting a wide range of file information, from one-digit code to a long paragraph of text, without restrictions on length, type or number of entries (fields) in a record. Many data management programs can be eliminated from consideration on this factor alone.

   There are now data management programs for the Macintosh (e.g., *Filevision* and *MicroSoft File*) which enable you to have pictorial data items as well as text and numbers. In the Inventions file, for example, we could have included drawings of the inventions or pictures of the inventors. When hardware and software with this capability are available in schools, it will greatly enhance the value of data bases for learning.

4. **Flexibility in naming data items.** It is important for students to learn to communicate ideas and information clearly and accurately. They shouldn't have to work with obscure or cryptic codes for data items. The program should say, "Number of games won this year," not "#GW" or even "#GAMWON." Programs that restrict data item names to a limited number of characters are undesirable.

5. **Files of meaningful size.** Students need—and like—to work with real data files, not "pretend" files. This means, at the present time, that a single file should be able to contain at least one disk's worth of information. For example, our Inventions file contains three pages of information on each of about 170 inventions, and takes up almost an entire Apple II disk. Thus, especially for files with a lot of text in them, choose programs in which the files are on disk while you work with them (e.g., *PFS:FILE*), rather than in the more limited memory of the computer (e.g., *AppleWorks*).

   The cost of large storage devices is dropping quickly, so in planning for students' use of data bases, be prepared to take advantage of much larger data base storage capability than most classrooms have at the moment. Clearly a file containing thousands of inventions, rather than the 200 or so in our example, would make possible a much richer array of problem-solving activities.

6. **Ease of manipulation and retrieval.** Students need to be able to very easily retrieve from the file a particular piece of information or collection of information that meets specified criteria (e.g., "All the presidents who were born in Virginia" or "all Republican presidents who were elected before 1890").

7. **Control over the way information is presented.** Students need practice in preparing information in a way that communicates effectively. They should be able to tell the program to print the selected information in the form of a graph, chart, table or list, sorted alphabetically or numerically.

Less Important Features

In exchange for ease of learning, ease of use and flexibility of format, certain capabilities in a data management program may be sacrificed at present. Speed of retrieval and sorting, for example, are less important for our purposes than they might be in a business office. Some of the more powerful data entry features such as ability of the program to compute entries or automatically verify accuracy of data formats may also be eliminated in the trade-off for ease of use.

Summary

Opportunities for student inquiry, problem solving and skill development with data bases are endless, and we are just beginning to explore the pedagogical, curricular and technical issues involved in exploiting the capabilities of computers for these purposes. The hardware and software tools to use are available now, and are improving rapidly.

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The Computerized Database: Not a Simple Solution

by Don Rawitsch

The Claims Sound Good

An election year has arrived. The television carries the speeches of the candidates for president daily. One says her party believes in a strong military. The other decries defense spending as a threat to world peace. Twelve-year-old Michelle wonders if the parties have always taken these stances. She goes to her computer, calls up a database of political and historical information, and types commands to see how many presidents from each party have been in office when the country has gone to war over the past 200 years. Armed with the results, she goes off to query her parents about their voting plans.

Typical scenario in today's homes? No. But in many classrooms this type of instructional use of computers is growing. And educational technology experts are saying that computer utilities such as databases are the tools that will finally allow students to access and analyze information for the purpose of answering questions and solving problems.

Bev Hunter (1983) has stated, "To survive and thrive in an information-based society will require that students learn skills and techniques for handling information. Computer programs such as databases . . . are tools students can use to learn, manage information, and solve problems in the social studies" (p. 324). Janet Parker (1986) adds, "Computer tools (such as databases) hold great promise for providing students with activities that develop higher level thinking skills—skills that involve creating, analyzing, synthesizing, and evaluating" (p. 21).

We Have the Tool

Significant attempts have been made since the 1960s to convince educators that students would benefit from investigating critical issues through a process of proposing and testing their own hypotheses. This activity, known in the social studies field as the inquiry movement, has paralleled efforts in other subject areas to emphasize process over the acquisition of facts.

Inquiry is a potentially powerful method, but it arrived on the education scene too early for widespread adoption. Neither enough data nor an easy-to-use analysis tool was available to classrooms 10 to 20 years ago. But with the advent of widespread computer use in classrooms and the availability of database programs for personal computers, perhaps inquiry's time has finally come.

Several assumptions are implicit in the call for computer database use:

1. Learning problem solving skills is a critical part of education;
2. Database analysis is an effective activity for developing problem solving skills;
3. Students will be more efficient (in terms of accuracy and time required) in completing database activities if they use a computer;
4. Students will enjoy database activities more if they use a computer in completing them;
5. Students will comprehend content better if they learn it through a problem solving activity such as database analysis;
6. Computer database activities are effective instructional experiences for all students of at least modest ability; and
7. Database use is an important carry-over skill for adult life, the development of which is best started during the school years.

But Where is the Research?

These assumptions sound logical and reasonable. But like so many aspects of computer use, little data exist beyond teacher anecdotes to convincingly demonstrate that the assumptions hold true. As Shirl Schiffman (1986) cautions, "Unlike the debate often triggered by discussions of CAI or Logo, almost everyone seems enthusiastic about teaching students to use 'productivity tool' software, such as database managers. Articles regularly appear with suggestions for adapting productivity tools to school subject areas, and with nary an accusation that the activities 'don't use the full power of the computer,' or 'there is no research data to suggest they are of any value.' Is this a category of applications for which there are no philosophical or pedagogical reservations?" (p. 27).

I conducted a study, carried out in social studies classes, designed to provide research findings related to assumptions 3 (on student work efficiency), 4 (on student affect toward computer use), and 6 (on student work style) by testing the following hypotheses:

Hypothesis 1

Students will be able to solve problems requiring the comparative analysis of data more efficiently by using a computerized database as compared to using noncomputer methods.

Hypothesis 2

Students will have more positive attitudes toward computerized methods of solving problems requiring comparative analysis of data than toward non-computer methods.

Hypothesis 3

Students with structured work styles will be more efficient in computerized database use than students with unstructured work styles.

The Study's Design

The study was carried out with about 275 eighth graders from 16 classes in three suburban Minneapolis-area school districts. The students progressed through an eight-day sequence of activities including the following:

1. Completing a written questionnaire designed to obtain a profile of the sample group and to determine student work style characteristics;
2. Receiving instruction in the nature of databases and the operation of the *AppleWorks* database;
3. Completing an eight-problem exercise using database information on geographic characteristics of world nations printed on paper;
4. Completing an eight-problem exercise using the world nations database on computer.
5. Completing an eight-problem exercise using a computer database on characteristics of new car models; and

6. Completing a written questionnaire designed to obtain data on how much students liked the various database activities.

Each of the exercises was designed as part of a progression from simple fact-finding questions to problems of testing an assumption (see sidebar on p. 36). Each item in the exercise required searching an entire database of about 125 records. The difficulty level of the exercises was chosen to provide a legitimate test of the study's hypotheses while allowing completion of each one within a single class period of about 40 minutes. Half the students were given the "on paper" exercise before the computer exercises and half did them in the reverse order to eliminate any bias that might be caused by the sequence.

Did the Computer Help?

Regarding Hypothesis 1, on work efficiency, students solved a greater percentage of problems correctly when they used the computer (84 percent) than when they didn't (78 percent). This difference is statistically significant at the .01 level.

However, they took longer to complete their work when using the computer (2.5 minutes per problem) compared to when they didn't (2.0 minutes per problem). This difference is significant at the .01 level.

"Efficiency" was defined as a ratio of speed (time needed to complete an exercise of eight problems) to accuracy (problems correctly solved). Using this measure, there was no significant difference between using the computer and not using it. This conclusion can be tempered somewhat by putting the efficiency differences into perspective. The increase of six percentage points in accuracy is perhaps *instructionally* significant, while the increase of half a minute per problem over eight problems might not be important in a class period 25 to 40 minutes long. Nevertheless, the notion that the computer's speed in calculating will result in students' working faster, and thus more efficiently, was not supported.

Did Students Prefer the Computer?

Regarding Hypothesis 2, on attitudes toward the computer, students liked solving problems using the computer better than not using it. On a five-point rating scale, they rated computer use an average of one point higher than using paper and pencil (3.7 to 2.7). This difference is significant at the .01 level.

Students rated the car shopping exercise significantly higher than the world geography exercise (3.9 to 3.7), indicating perhaps that "real-life" problems interested them more.

Work Style and Computer Efficiency

Student learning style is currently a topic of great interest to educators. The work of Anthony Gregorc, Kathleen Butler, David Kolb and Rita Dunn, among others, suggests that individual styles can be categorized (see Dunn [1979]; Fizzell [1984]; Gregorc and Butler [1984]). If the styles of particular students can be determined, teachers may be better able to individualize instruction.

Most of the measurement work in this area has focused on college-level and adult learners. No suitable published written-response instrument for classifying the learning style of eighth-grade students was available to me. Extensive trained observation of students can be used but was beyond the scope of this study.

Kathleen Butler (1984) has described characteristics of different student learning styles. Following is a list of some of Butler's characteristics for the "concrete sequential" and the "abstract random" learner:

Concrete Sequential Learners

work best when they . . .
have an orderly environment
know the accepted way of doing things
have exact directions and examples
can apply ideas in a practical way
can be consistent and efficient
may have difficulty . . .
choosing from among many options
acting without specific direction
taking new approaches waiting and
sitting still

Abstract Random Learners

work best when they . . .
can work and share with others
get personal attention
get emotional support
have freedom from control of others
use personal or artistic expression
have assignments requiring interpretation
may have difficulty . . .
giving exact answers
working step by step
working within time limits
organizing plans

I used these characterizations to create an instrument that might differentiate "structured" from "exploratory" *work* styles. No claim is made that this instrument determines how a student *learns*. It simply focuses on preference of work habits.

Hypothesis 3 speculates that structured students would have more success in using the computer. This is based on the idea that database searching strategies follow a sequential set of steps. However, the use of utilities such as databases is often touted for the ability to answer "what if" types of questions—a good fit to the exploratory work style. Thus, a reasonable rationale also exists for stating the hypothesis in the opposite direction: Students with *exploratory* work habits will be more efficient in computerized database use.

Students in the study were asked to respond to 10 choices, such as the three below:

Which would you rather do in your school work?

> Follow instructions OR do things in a different way?
> Understand the details OR get the general idea?
> Be given exact due dates OR be allowed to set your own timeline?

Students were scored on how many times they chose the structured choice versus how many times they chose the exploratory choice. (In the items above, the structured choice is listed first.)

Scores were determined by counting one point for each structured option chosen in the 10 items. Thus, scores could range from zero (highly exploratory) to 10 (highly structured). The resulting distribution of scores was fairly even, with a mean of 5.5. On nearly all 10 of the items, choices across the total sample of students were split 50-50 or 60-40 between the exploratory and structured choices.

Students whose work styles tended toward structured performed more efficiently (as a ratio of time to accuracy) than those whose work style tended toward exploratory. Students at the structured end of the scale averaged about half a minute less per problem correctly solved than the exploratory students (2.5 to 3.0). This difference is significant at the .05 level.

An Additional Observation

The teachers in the study were very conscientious about completing the mechanics of the activities correctly, and they did a creditable job of this. In the process, however, they sometimes overlooked the followup questioning that is critical to effective instruction. For example, students used the world nations database to find the country with the lowest life expectancy for its citizens (Sierra Leone in Africa). As a followup, this country should have been located on a map. The students used a database to find the country with the highest per capita gross national product (United Arab Emirates). As a follow-up, reasons for this should have been discussed. Students used the car shopping database to find the best cars on today's market, based on a specified set of criteria, and discovered that they all came from Japan. As a follow-up, the impact of this on the United States economy should have been discussed. The fact that this type of followup was sometimes overlooked did not affect the results of the study but may have diminished the ultimate instructional value of the activities.

Implications for Curriculum and Instruction

Of greatest importance is the message that problem solving with computer databases, like other aspects of computer-related instruction, cannot effectively be learned as a one-time activity or unit in the curriculum. Using only one time block (e.g., one to two weeks) in one subject area at one grade level to cover this skill does not necessarily justify using the computer in terms of student work efficiency. A few years ago "computer literacy" became a rallying cry and then a scourge as schools tried to implement the concept as a single, isolated course. The same mistake must not be made with database use.

Second, the message that students with differing work styles do not always perform with equal efficiency under the same instructional method deserves further examination. Taking all the students in a class into a computer laboratory and asking them to follow the same sequential set of instructions might ensure that only 50 to 75 percent of them will be successful in the activity. Teachers should be prepared to use alternative strategies matched to the differing styles of students. For example, students with more structured styles might prefer working alone and recording answers step by step on a worksheet, while students with less structured styles might prefer working in small groups and keeping personal diaries of their work.

Third, regardless of performance efficiency, it appears that students prefer computer use over manual methods for analyzing data and prefer working with data in which they have a personal interest (e.g., car shopping). In this study the personal interest data was used as an application after skills had been learned. Conversely, it could be used as the "hook" to interest students in the skill before using the skill with data of a more academic nature.

Finally, teachers must not focus on mechanics to the point that an instructional sequence is lost. Having students analyze data on a computer is a far more complex lesson than lecturing on a country's geography. It requires planning, practice and familiarity on the part of the teacher. In this setting, computer use is the means to an end. Helping students learn how to interpret information is every bit as important in this instructional sequence as helping them learn how to gather and compare that information.

This study is only a first step. Our beliefs about the value of using computer tools in the classroom will be shaped not by one set of results, but by a survey of many. For example, further research might well show that students who have the opportunity to reinforce their initial learning of database use periodically during their schooling will be significantly more efficient at finding information and solving problems with the computer than at using paper and pencil methods, and will be able to solve problems of greater complexity.

Using the computer to analyze collections of data provides new avenues of instruction in such subjects as social studies and science. This tool may finally make inquiry teaching practical. As a social studies educator, I continue to be enthusiastic about the potential of this tool for developing questioning, analysis and interpretation skills in students. Teachers should not, however, assume that the wonders of the computer translate automatically into wonderful learning. Teacher planning, curriculum integration, and student work styles are all critical factors, and more research results are needed to test our assumptions about which methods will lead to successful instruction.

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Car Shopping Database
Student Exercises Using the Computer

1. What is the price of a Cadillac Fleetwood?
2. Which car has the best MPG rating?
3. What auto maker(s) have the most models in the "top 10" for customer satisfaction?
4. I've always bought Fords, and now I want the one that gives me the highest MPG. Which car do you recommend for me?
5. I want the largest engine I can get in a car that won't cost me more than $9,000. Which car do you recommend for me'?
6. Cars with big engines sometimes have the image of being unsafe. Are there any cars that are in the top third for *both* engine size (above 170 cubic inches) and safety rating (below 2,000)? List them.
7. I would like a car that is among the top 20 percent for customer satisfaction (rating above 110), has four doors, and costs less than $6,500. Which car(s) do you recommend for me?
8. Everyone has his or her favorite car, for many different reasons. You determine the *best* car on the list based on a combination of the five reasons below:

   It's in the top 25 percent for fuel economy (above 25 MPG);
   It's in the top 25 percent for safety rating (below 1,950);
   It's in the top 25 percent for customer satisfaction (above 102);
   It's roomy enough to have four doors; and
   It costs the least of all cars that meet the first four reasons

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Learning to Like SOCIAL STUDIES

by
Betty Collis

Social studies, the study of people and how they interact, has great potential to be personally relevant and motivating for students. Despite this potential, research shows that student interest in social studies is surprisingly low and declines even more the longer students study the subject in school. Shaughnessy and Haladyna (1985) summarize the research literature by concluding that "most students in the United States, at all grade levels, find social studies to be one of the least interesting, most irrelevant subjects in the school curriculum."

Concerned educators must address the obvious question: Why? Why do many students find the study of people disinteresting? What can be done to promote better achievement of the goals of the social studies curriculum and at the same time increase student interest?

Betty Collis addresses these and many other questions in her new book, *Computers, Curriculum, and Whole-Class Instruction.* She begins by reviewing relevant literature in each of four subjects—social studies, science, language arts, and math—then references research relating to the impact of computers on teaching and learning in those areas.

Collis' book, however, is not exclusively theoretical. It is unusual in that it synthesizes extensive research findings with numerous practical ideas that are ready for classroom use. It contains nearly 100 lesson plans, many of which use generic computer tools: word processors, databases, spreadsheets, graphics, and telecommunications. And as the book's title suggests, the lesson plans are designed to be implemented with one computer and an entire class.

In the following excerpt from chapter 2, "Computers and Social Studies: Applying Critical Thinking to Information," Collis outlines three lessons designed to increase students' involvement in their learning and help them inquire into phenomena relevant to their lives. These lessons were designed to enhance students' personal connection to their studies by using student surveys, supported by database or graphing programs.

[For detailed information on designing a database for use with your students, see "Problem Solving with Data Bases," by Beverly Hunter, in the May 1985 issue of *TCT.* For information on searching, see Larry Hannah's "Teaching Data Base Search Strategies" in *TCT,* June 1987.]

The Survey: Using People As a Data Source

Conducting a Neighborhood Survey

Surveys can be used either to describe a population on the basis of some factual characteristics or to discover people's opinions. Initial survey experiences should require students to collect information that is as objective and uncomplicated as possible. Social Studies Lesson 7 relates to a Grade 6 unit on the national backgrounds of the U.S. population in the context of immigration patterns.

Comments on "The Melting Pot"

Lesson 7 has three benefits. First, it gives the students experience in participating in a survey, with its attendant difficulties, and should make them more sensitive to the types of errors that accompany any sample survey. Second, it makes the topic of movement in the world community much more relevant. Keely (1986) has noted that students do not appreciate the distinctions between immigrants and refugees or the major changes that have occurred in immigration patterns to North America, with the relatively recent switch from European to Asian and Hispanic immigration. This lesson can also be used to help students better understand the difficulties faced by immigrants to a new land. Third, it illustrates by use of a graphing program how graphic displays can summarize and focus information.

Conducting a Banking Survey

Another excellent survey idea can be incorporated into a Grade 8 study of banking and the effect of technology on banking. This focus of study provides an excellent opportunity to integrate different curriculum areas; the topics could be part of a mathematics unit, a science unit, or a social studies unit on current technological issues. Ross describes how his students developed a questionnaire, pilot-tested it on their parents, and spent a class period on a busy main street asking passersby to respond to the survey (Ross, 1984). They obtained 133 sets of responses during the hour and took turns, back in the classroom, typing in the results in a database they had already prepared. We have adapted Ross's ideas for Social Studies Lesson 8.

Comments on "You Can Bank on It"

Asking good questions is the most important aspect of this set of lessons, both in the context of the survey itself and in the analysis and evaluation of the information obtained. The computer is important in two ways as well. First, it aids the students in the display and organization of their information and "adds speed and accuracy to the testing of hypotheses. . . . Suddenly, it becomes possible to test one's hunches" without time-consuming and tedious hand-generation of tallies of different categories of information (Ross, 1984). Second, the computer becomes a legitimate object of study, as well as a tool, when students consider its impact on bank work and customers. Some issues relating to privacy and computer crime might also be relevant, especially since students have little awareness of the implications of these concerns as social issues (Collis, 1986; Diem, 1985). Some questions to consider: What potential security problems are associated with money machines? How might the bank use a database program? Are there potential security problems?

Interpreting and Evaluating Sources of Information

Interpreting Graphs

Graphs appear frequently in magazines and newspapers. In order to interpret them intelligently, students need continual practice in the analysis and evaluation of printed graphs. Social Studies Lesson 9 illustrates the use of a computer in connection with this sort of activity.

Bias in Information

Lesson 9 uses the computer to redisplay information, partly to help students become better at interpreting graphic information. However, another purpose involves the idea of bias in information; that is, can an author lead us to conclusions that may not be fair by the way a graph is presented? The same opportunity to influence the reader occurs in the headlines of newspaper and magazine articles. Bias can be detected in the choice of an exaggerated or emotional adjective, or it can be more subtle, through the choice of what to write about and what to omit. Certainly, the teacher can and should have the students bring in headlines for discussion and evaluation in terms of bias. However, illustrating the influence of omissions on our opinions about an issue is more difficult. This problem is compounded by the difficulty in obtaining a sufficient variety of newspapers and magazines to search for pertinent articles (or omissions). Using a computer to access a real-world on-line magazine or newspaper database can bring the appropriate resources into the classroom.

Lesson 7

The Melting Pot

Using a Graphing Program

Equipment Requirements

Software: Any graphing program
Other: Printer

Objectives

- *People from many countries move to other countries to live*
- *Collect, organize, and summarize information*

Lesson Description

Discuss the fact that many people move—within communities, within countries, and between countries. Discuss briefly the difference between immigrants and refugees and, more generally, the reasons that motivate people to move. Survey the class to see how many were born in a different country from that in which they now live. Make predictions about the countries of birth of people in the community surrounding the school.

Define *survey* and briefly discuss some strategies for asking people questions and for efficiently recording their responses.

Keep the planned survey very simple, as would be the case with the two questions suggested in the sample. Stress the importance of being sensitive to anything that might embarrass a respondent. Compose a cover letter to present to people being surveyed and a letter to parents explaining the purpose of the activity. If parents do not wish their child to go door-to-door in the neighborhood, suggest that they allow the child to telephone friends or relatives. Suggest that each child survey six households.

Tally the information, finding the means and ranges of time people from various countries have lived in this country. Plan different ways to tabulate and graph the data. Use a graphing program to test different graphing plans.

Follow-Up Activities

Look for patterns and trends in the survey information. Did people who immigrated more than 20 years ago tend to come from different countries than those who immigrated in the last five years? Why might these immigration trends occur? Would the survey results be similar or different if a different neighborhood or city had been surveyed?

Sample

Survey Questions:

In which countries were the people who live in this house born?

For anyone not born in this country, how long has he or she lived here?

Lesson 8

You Can Bank on It

Using a Database Program

Equipment Requirements

Software: Any database and graphing programs
Other: Printer

Objectives

- *Social implications of banking and technology*
- *Collecting, organizing, and interpreting information*

Lesson Description

In the context of lessons on the impact of technology on the workplace and on individuals, discuss banking services available in the local community. How does technology affect the customer? What are some of the benefits? Some of the potential problems? How has technology affected the people who work in the bank? Does the bank need fewer employees if it makes intensive use of technology? More generally, what sorts of services do banks provide? How does a bank differ from an investment house or a savings and loan institution?

Have the students collect information from a variety of sources—descriptive materials in banks themselves, advertisements, magazine articles—and from a survey. Develop a survey form such as the one which follows (Banking Survey) and discuss an appropriate strategy for obtaining responses to the survey.

Collect the information and over time enter the responses on each survey form into the database that has been prepared to go with the form. This procedure can go quickly if each response category is coded with a letter and only the letter entered into the database.

Follow-Up Activities

Once data are collected and entered into a database, develop tables or graphs that summarize the data. Formulate and try to answer various questions, such as Was there a significant difference between customers of different banks when they answered the question about thinking of changing their banks? Are different banks more popular with different age groups? Do younger people use money machines more than older people?

Sample

Make a prediction:

Do you think there will be a difference in the number of men and women who have savings accounts?

Why might there be a difference?

Banking Survey

Please help us collect information for our Grade 8 study of banks and people by circling the most appropriate response to each question.

1. Your age category:
   (a) Under 20 (b) 20-64 (c) 65 and over
2. Your sex:
   (a) Male (b) Female
3. Do you have a checking account?
   (a) Yes, in my name only (b) Yes, a joint account (c) No
4. Do you have a savings account in a bank?
   (a) Yes, in my name only (b) Yes, a joint account (c) No
5. Do you use a money machine?
   (a) Yes, frequently (b) Yes, but only occasionally (c) No
6. Which bank do you deal with the most?
   [List local banks]
7. Do you think cash cards are useful?
   (a) Yes (b) Only a little (c) No
8. Do you think there are more dangers in using cash cards than in doing banking in the traditional way?
   (a) Yes (b) Only a little (c) No
9. Are you thinking of changing your banking business to another bank or savings and loan?
   (a) Yes (b) No

Lesson 9

Pictures Speak Louder Than Words

Using a Graphing Program

Equipment Requirements

Software: Any graphing program
Other: Large color monitor, printer

Objective

- *Interpret and evaluate graphic displays*

Lesson Description

Bring in a colorful graph from a newspaper or news magazine. Challenge the students to describe what the graph is displaying, both in terms of content and in terms of suggestions made by the look of the graph. Identify the source of the information, the data, the meaning of the divisions in a bar or circle graph, and the scale used in a line graph. Is there a zero line?

Use a graphing program to generate the same data in either bar or line graph form (depending, of course, on the type of data involved). Does the graph give a different impression without the colorful pictorial framework that surrounds it in print? Change the title of the graph. Can the title unduly influence or bias the reader? If it is a line graph, rescale one or both of the axes. Do the students sense a different message when the graph is organized differently? Can the publisher bias information through the look of a graph?

Follow-Up Activities

Have everyone contribute to a collection of graphs from popular magazines or newspapers. Distribute the graphs randomly to pairs of students in the class. Using the graphing program, have each pair of students attempt to redraw the graph twice: first so it looks as much as possible like the printed graph, and second to show how changes in the title, scaling, or labels can cause the graph to convey a different message.

Sample

How can a graph suggest to us the message we are supposed to get from the information?

From Computers, Curriculum, and Whole-Class Instruction: Issues and Ideas *by Betty Collis.* © *1988 by Wadsworth, Inc. Reprinted by permission of the publisher.*

[Betty Collis, Dept. of Psychological Foundations, Faculty of Education, University of Victoria, P.O. Box 1700, Victoria, BC, Canada V8W 2Y2.]

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The Computing Teacher October 1987

Databases in the English Class: A Valuable Lesson

by Ruthie Blankenbaker

The idea of using data bases in the English classroom raises some questions: How do I use them? When do I use them? And most important, why *should* I use them?

Not too long ago many English teachers were perplexed about the computer's benefits to the writing student, and then they discovered word processing. I conjecture that these same teachers will soon unearth the treasure of data bases as the stimulus for analytical thinking and writing.

I stumbled upon this stimulus for writing quite by accident. Simple ideas sometimes grow, develop and mature into a life of their own. This happened with a values survey idea in my computer skills class for seventh and eighth graders. Beginning as a task through which students would gain further data base manipulation skills, it matured into a composition activity that rewarded academic and personal growth.

My goals are simple for middle school students who attend the year-long class, two days a week. As much as possible they use their word processing, data base, spreadsheet and telecommunications skills in other content areas. The values survey project, though, began as one that had no apparent connection with any other class. And that was fine. Students needed further practice with generating reports and tabulating totals with the data base. The survey was designed to give them much practice with these, and it wasn't necessary for the project to be integrated.

Because the mention of "values" in any school setting is always controversial, I explained clearly the project's purposes: It would result in interesting, valid data that could be manipulated in many ways. I led class discussions about how our senses of adventure and the importance of family, power, money, aesthetic beauty, etc., change continually, depending upon age and circumstances.

I then gave students two survey forms—one for them to complete and one for a parent or other significant adult to complete. Each identical survey contained 104 questions to which students and adults responded by placing a check in appropriate columns: "Very True," "Sometimes True," "Not Sure," or "Not True."

Wanting to protect the privacy of individuals, I assigned an identification number to each student and each adult which designated gender, grade, and student or adult status. This number later became a piece of information entered into the data base files. Assuring anonymity, the ID number also held the power for manipulation of data. By using this number along with the Contains feature in the record selection process, students could compare data in many ways.

After students and adults completed the survey, I instructed students to place a "9" above the words "Very True," a "6" above "Sometimes True," a "3" above "Not Sure," and a "O" above "Not True." By transferring the corresponding response value to each question onto a recap sheet, students completed the paperwork of our computer activity.

Prior to the on-computer time I prepared and placed on student data disks an *AppleWorks* database file that contained four categories: ID #, Question #, Value Code, and Response Value. Because I had already input the question numbers and their corresponding value codes (information from the master questionnaire) in each record, the students needed only to enter the ID numbers and the recapped values for each question. Next they retrieved reports, sorted according to selected values, and then totaled the numeric results.

By noting which value category had the highest total, students could see which was most important to them and/or their adult. However, values usually change, so I suggested that they take the Values Survey again in a year or two to compare results. But for now this was an easy way to see difference between their values and those of their parents.

The activity grew. Students questioned, and as they did, they returned to the database, attempting to discover answers. "Couldn't we put everyone's ID numbers and the totals of the value codes into a master database?" they asked. ""That way we could make all kinds of comparisons." With this statement, I recognized the perfect moment of integration—writing the compare and contrast paper for the English class.

Question by question, students unearthed the hidden treasure of databases: They remove the drudgery of sifting through unwieldy amounts of information and leave in its place time for more important tasks, such as wondering in amazement at their first, hard-evidenced glimmer into the discovery of self. Or being astonished at how similar to or different from their parents or peers they are. Or acquiring an awareness of their value systems. Or beginning to recognize who they are apart from parents or other significant adults.

The right ingredients were mixed: The data were personally meaningful; the students were questioning and analyzing; the power of the database removed the drudgery of physical sorting and stimulated thinking. Students could now write the compare and contrast paper about something meaningful to them.

I turned the idea over to our English teachers. They loved it. Within a short time students were solidifying their thoughts by writing about them. They were acknowledging their value systems; developing intellectual sophistication and sensitivity; and learning who they were compared and contrasted with others. Students were writing the compare and contrast paper with captivating, personal interest.

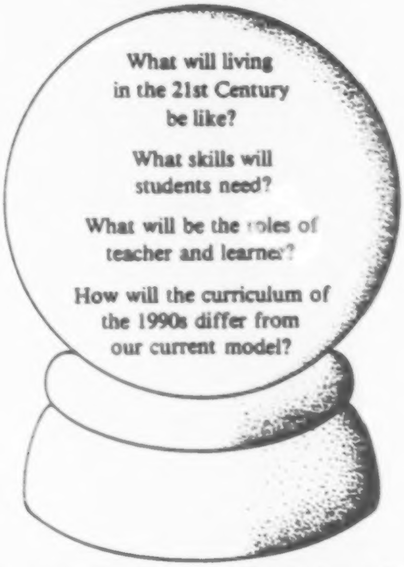
Databases *are* powerful tools. They can pose interesting questions without "right" answers and pose problems that have multiple solutions or no answer at all. Our society needs thinkers and writers who can work with these kinds of questions and problems. By using database projects as the stimulus for thinking, English teachers can go a long way toward seeing that society's needs are met.

What began as a simple "manipulative skills" task in computer class matured into an understanding of the value of databases in the English class, a treasure I'm sure other teachers will soon unearth in varied and interesting ways.

[Ruthie Blankenbaker, Park Tudor School, 7200 North College Ave., P.O. Box 40488, Indianapolis, IN 46240-0488.]

The "Why" of Instructional Computing

by
Suzanne Bailey



What will living in the 21st Century be like?

What skills will students need?

What will be the roles of teacher and learner?

How will the curriculum of the 1990s differ from our current model?

Suzanne Bailey's visuals help educators understand the "why" of instructional computing—the big picture of where we are going. They can provide a framework for a district's long term planning or a springboard for presentations on tool uses of software, cooperative learning, higher level thinking skills, teacher as facilitator, etc.

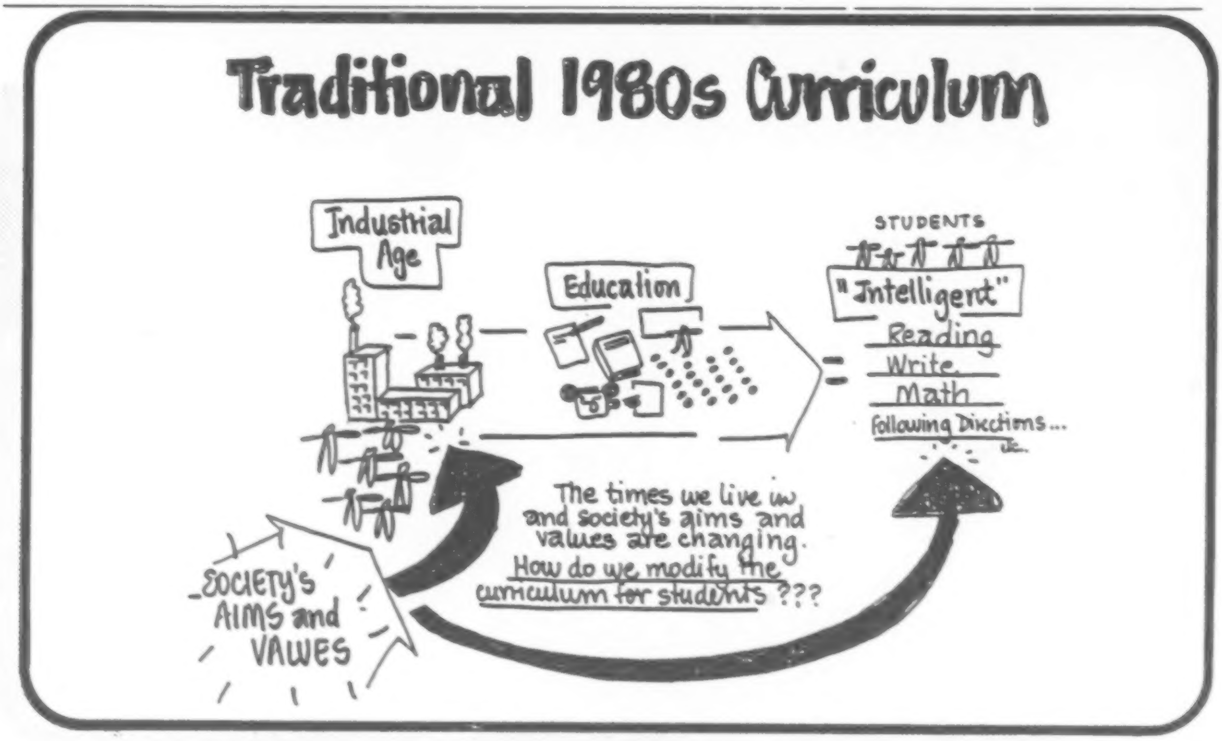
Use the visuals to stimulate thought and discussion. You will need to design stimulating questions and possibly gather additional quotes or information. In the author's words, "Use and Extend!"

The 21ST CENTURY

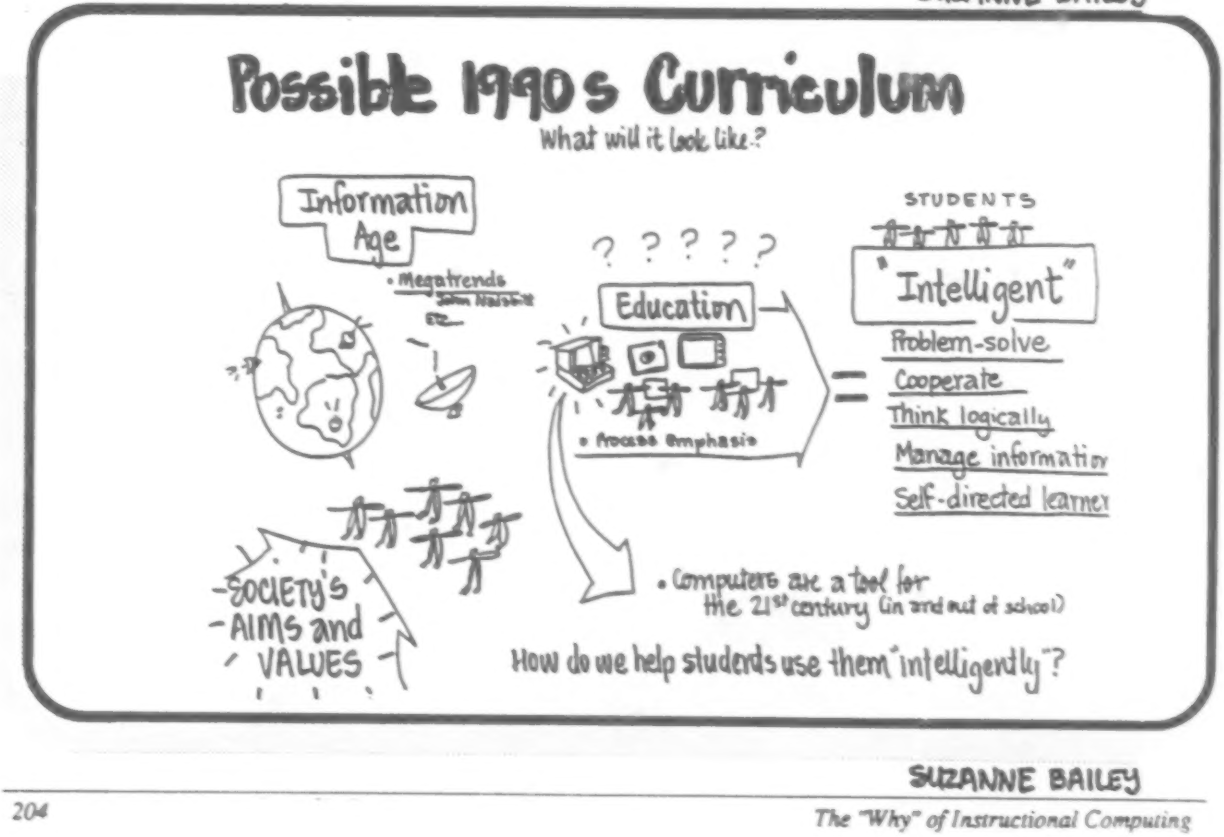
A SCENARIO for STUDENTS...

- 6+10 CAREER CHANGES
- NEW TYPE of JOBS
  - PARTNERSHIPS
  - VALUE-ADDED
  - TOOL INTERACTION
- INCREASED INFORMATION
  - ACCESSIBILITY
  - AMOUNT
  - DIVERSIFICATION

SUZANNE BAILEY


Traditional 1980s Curriculum
Industrial Age
Education
STUDENTS
"Intelligent"
Reading
Write
Math
Following Directions...
etc.
=
The times we live in and society's aims and values are changing.
How do we modify the curriculum for students ???
SOCIETY's AIMS and VALUES

SUZANNE BAILEY


Possible 1990s Curriculum
What will it look like?
Information Age
• Megatrends John Naisbitt
etc.
? ? ? ? ?
Education
• Process emphasis
STUDENTS
"Intelligent"
=
Problem-solve
Cooperate
Think logically
Manage information
Self-directed learner
• Computers are a tool for the 21st century (in and out of school)
How do we help students use them "intelligently"?
SOCIETY's AIMS and VALUES

SUZANNE BAILEY

Intelligence

From the book, Gödel, Esher, Bach, by Douglas Hofstaater:

The essential abilities are to be able to

- respond to situations very flexibly;
- take advantage of fortuitous circumstances;
- make sense out of ambiguous or contradictory message
- recognize the relative importance of different elements of a situation;
- find similarities between situations despite differences which may separate them;
- draw distinctions between situations despite similarities which may link them;
- synthesize new concepts by taking old concepts and putting them together in new ways;
- come up with ideas which are novel.

From Godel, Escher, Bach: An Eternal Golden Braid by Douglas R. Hofstadter, copyright © 1979 by Basic Books, Inc. Reprinted by permission of Basic Books, Inc.

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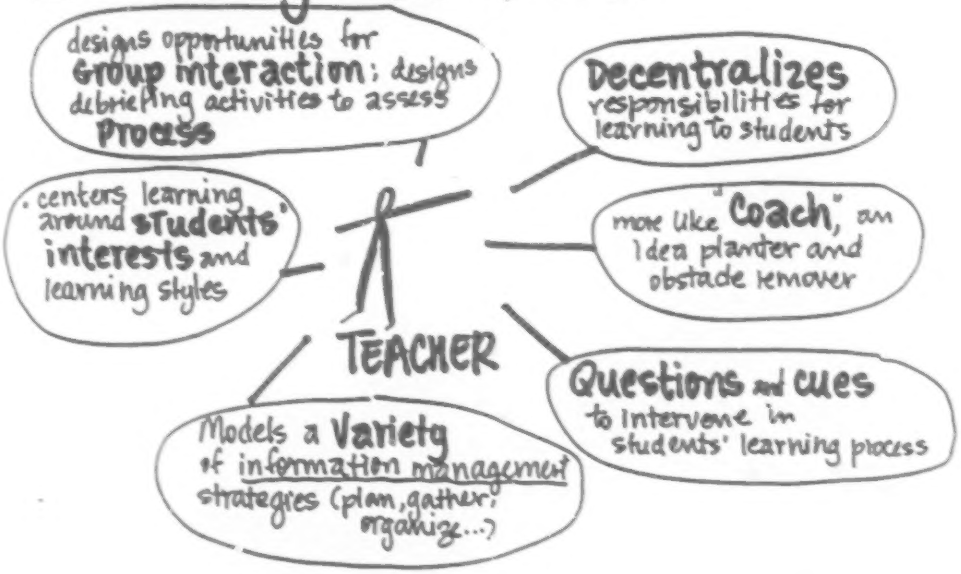
21st Century Roles & Skills



designs opportunities for **Group interaction**; designs debriefing activities to assess **Process**

Decentralizes responsibilities for learning to students

centers learning around **students' interests** and learning styles

more like "**Coach**," an idea planter and obstacle remover

TEACHER

Questions and **cues** to intervene in students' learning process

Models a **Variety** of information management strategies (plan, gather, organize...)

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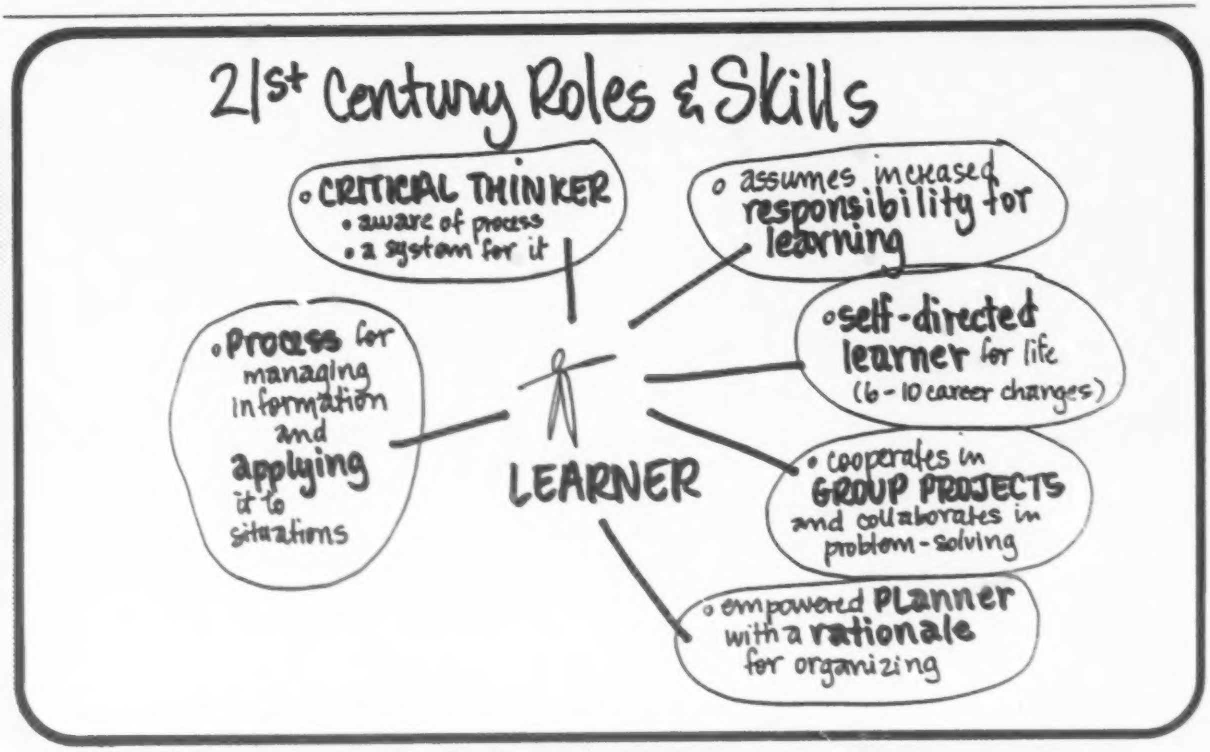
BEST COPY AVAILABLE


21st Century Roles & Skills
CRITICAL THINKER
aware of process
a system for it
assumes increased responsibility for learning
Process for managing information and applying it to situations
LEARNER
self-directed learner for life (6 - 10 career changes)
cooperates in GROUP PROJECTS and collaborates in problem-solving
empowered PLANNER with a rationale for organizing

SUZANNE BAILEY

The Computing Librarian

Continued from page 40

MIND and MicroAccess are available only for IBM PCs at a cost of $125. MicroAccess is a menu-driven program that allows set building and Boolean logic searching. Like ERIC MICROsearch it is probably best used in schools as a simulation teaching aid. Other data base subsets are available to use with MicroAccess.

For more information about MIND or MicroAccess contact:

Database Services
P.O. Box 50545
Palo Alto, CA 94303
or
Knowledge Access
445 E. Charleston Road
Palo Alto, CA 94306

[Carol Tenopir, Graduate School of Library Studies, University of Hawaii at Manoa, Honolulu, HI 96822.]

Beyond Merlin and His Magic Staff

Continued from page 32

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**************************************
**
**              DREAM FOCUS
**
**************************************


**************************************
**
** Use the down arrow key to move
** through the activity.
**
**************************************

**************************************
**
** Type your name below the prompt box.
**
**************************************

**************************************
**
** Type the date below the prompt box.
**
**************************************

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**
** As you read through the prompt,
** you will be making notes below the
** boxes to use as references when
** you write your version of
**
**             DREAM FOCUS
**
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**************************************
**
** WHAT TIME DO YOU GO TO SLEEP AT
** NIGHT?  HOW MANY HOURS DO YOU
** USUALLY SLEEP?
**
**************************************

**************************************
**
** HOW LONG DOES IT TAKE YOU TO FALL
** ASLEEP?
**
**************************************

**************************************
**
** DESCRIBE YOUR DREAM.  DO YOU DREAM
** IN COLOR OR BLACK AND WHITE?
** DO THE DREAMS SEEM SO REAL THAT WHEN
** YOU WAKE UP IT ITS ALMOST LIKE YOU
** REALLY HAD THE EXPERIENCE OF YOUR
** DREAM?
**
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**************************************
**
** Now imagine you are going to
** tell someone about a dream.  Write
** about this dream as though you were
** telling it out loud.
**
** START YOUR DREAM STORY BELOW THE
** LINE.
**
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**
** Use Control B to go to the beginning
** of the prompts.
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WORLD Making Sense of POWER

by

Alice Jagger, Tom Layton, and Bob Veeck

Assume you are a secondary school teacher and your assignment is to teach World History, World Geography, or Global Studies. Do you have access to student materials that address the key issues, topics, concepts, and ideas that students will face in the remainder of this century and into the next? Do you have teaching materials that adequately discuss the major issues of the past? Do contemporary instructional materials help students to truly understand the human condition?

More often than one would like to admit, the answer to the above questions is "No." For one reason or another most publishers seem to avoid certain topics, from racism to the causes and costs of war. Power, which most authorities describe as the central or most significant concept in international relations, is often skipped over or treated superficially in materials typically available.

Our Search

We began a quest for teaching materials that covered these significant topics. We wanted to provide students with up-to-date information they could analyze and from which they could draw meaningful conclusions. As a result we developed *The Power of Nation States*, an *AppleWorks* data disk and accompanying courseware. It consists of three databases, two spreadsheets, a 50-page text, a teacher guide, tests, student worksheets, and six major lesson plans.

Teachers can use this courseware to introduce global statistics, analyze the concept of power, teach basic concepts of history and geography, teach thinking and analysis, and challenge students to draw their own conclusions about power relationships in the contemporary world. Each stage of our development process brought new additions as the initial data disk evolved from two databases to a complete courseware package.

Stage One

Most teachers of social studies do not use computers or computer courseware; a few years ago, neither did we. As global studies teachers, we were asking students to collect data and write reports, but the data collection took so long that students found themselves with relatively little time to analyze the information and draw meaningful conclusions. We began to doubt the educational benefits of such extensive research. Our initial solution, or Stage One, was to develop two rather comprehensive *AppleWorks* databases.

The first database, called Power, has 28 categories of information about 167 nations. The categories include Population, PCI, Gross National Product, Political System, Alliance Membership, Percentage of Population with Safe Water, Literacy, Area in Square Kilometers, Total Value of Imports and Exports, Number in the Armed Forces, and Nuclear Forces. This database includes what we consider to be the main factors in trying to assess a state's power.

The second database, Trade and Culture, contains an additional 24 categories. In order to make comparisons easier, some of these topics are redundancies from the first disk. New topics include Life Expectancy, Languages, Natural Resources, Infant Mortality, Religions, Exports, Imports, Trading Partners, Date of Independence, and from whom Independence was won.

But what do you do with large quantities of information, manipulated or otherwise? Gradually, we discovered the power of *AppleWorks'* simple commands. By arranging records and changing the layout, students are able to see relationships they might otherwise miss. By studying these relationships, they can create and test hypotheses about the states of the world.

Students reacted positively to such hypothesis testing activities. We were encouraged and challenged; we added more complex activities such as creating new fields calculated from existing ones. For example, there are fields called Amount of Energy Produced and Amount of Energy Consumed. To see what countries are in energy deficit, students created a new field that was a result of subtracting the energy consumed from the energy produced fields.

At this point though, we still felt we hadn't discovered the real learning potential of the database. While it is convenient to have access to information and it is nice to have it readily available for classroom use, we felt the need to increase the probability that significant learning would take place.

Stage Two

During Stage Two of developing our courseware, we began to explore the possibility of building lessons that called for students to use the database in more carefully defined and structured patterns. For our global studies class we had identified the concepts we believed were vital for student understanding of our complex world, and power emerged as one of these. Students who understand the concept of power and its uses in the international system are better able to identify the major global actors and their national interests, and can more perceptively analyze and evaluate their behavior. Power had also emerged as a key idea expressed by the approximately 8,000 pieces of data we had accumulated.

We created six lessons that used the database files to teach the concept of power. Lesson One asks students to create two new files in which they 1) identify if they recognize the states or not, and 2) identify if they are friendly or hostile to the United States. In both instances students were asked to manipulate the data to draw conclusions about the general characteristics of states that were recognized, not recognized, friendly, or hostile. Lesson One is the first of several lessons based upon the students' own perceptions. We wanted students to get used to the idea that there are no *correct* answers.

In Lesson Two students compare the United States and Egypt, using both database files, to identify the differences between First and Third World countries. These countries are good examples of each type, and they clearly establish the parameters of First and Third World status.

In Lesson Three students compare Japan (a highly industrialized democracy), the USSR (a highly industrialized Marxist-Leninist state), and Bangladesh (a Third World country), to determine the differences between First, Second, and Third World states.

In Lesson Four students are introduced to the concept of power. They are asked to arrange the Power database "From 9 to 0" by population and nine other categories to identify the top 15 states in each category. Using the printouts, students are to determine which 15 countries seem to be the most powerful.

Lesson Five is the showcase of the entire package. It makes maximum use of the computer's power and enables students to combine subjective judgments about power with objective facts about the 167 states in the world.

In this lesson students are introduced to a spreadsheet called the Power Grid. This spreadsheet contains a formula that assigns points for population, per capita income, total military expenditures, and nine other categories. Students are asked to analyze the formula and then reassign points according to their perceptions of how important a particular component of power should be. Then the spreadsheet can be calculated and the countries rearranged from 1 to 167 based on the results. See sidebar on this page.

An important part of this lesson is that power is an elusive concept and reasonable people may interpret numerical data quite differently. There is little agreement about the nature of power. In this activity students have used their own unique formulas to identify the most powerful states in the international arena. In the process of developing their own formulas, they must understand and analyze the categories, examine their own intuitions about the importance of each category, and finally synthesize all of this into their personal ranking systems.

In Lesson Six students use the Power database to print a report giving totals for a variety of categories, with subtotals for NATO and Warsaw Pact countries. They also use a spreadsheet called the Alliance Grid and the formulas they developed in Lesson Five to determine the relative power of NATO, the Warsaw Pact Alliance, and nonaligned nations.

Stage Three

Our courseware now consisted of a Power database, a Trade and Culture database, a Power Grid spreadsheet, and six lessons on the concept of power. Students were learning new terms, covering a lot of geography and history, and practicing thinking and analysis.

At this point in the process we had put together more relevant and up-to-date statistical data than we had ever seen in one set of materials for global studies instruction. This information could be manipulated and approached by students in a number of ways. We were certain that we had used the full power of the computer. But in spite of this,

The Power of Nation States

Student Lesson 5

Computer Directions:

Load in the *Power Grid* file. This file is a spreadsheet rather than a database. On the right hand side of the spreadsheet toward the top are the formulas that will help you calculate the relative power of each state represented. Below that are the values for each category within a state and a TOTAL amount of power points for each state. A starting set of values has been inserted and calculated. To see the results of this initial calculation place the cursor on the first TOTAL score and press OPEN APPLE A to arrange the states in order of power points. Use the DOWN ARROW key until you reach the bottom of the list, and press RETURN. Arrange "From 9. to 0" and press RETURN. Use OPEN APPLE H to dump the screen showing our power formula. (Use OPEN APPLE Z to switch between formulas and values in the cells.) Then dump the screen again, showing the top 15 states according to our formula. Please take notes during discussion on the following questions.

Questions:

1. Are there any states among the top 15 that you believe do not belong there? What are they? Why do you believe they shouldn't they be there?
2. In terms of the rank order of these states, are there any that you would like to see switched to a different position? What are they? What order should they have been in?
3. The Peoples Republic of China received a tremendous number of points for population. Do you feel that too many points have been allotted for the number of people in a given state?
4. The USSR received a large number of points for its Sq km/1000. Do you feel that too many points have been assigned for Sq km/1000?
5. Review your data from Computer Lesson 4 to derive a sense of which states seem to have the most assets in each category. Review our formula and try to ascertain which components of the formula have been weighted inaccurately by the authors.

something seemed to be missing.

We had assumed teachers would be reasonably familiar with the most contemporary definitions, explanations, and conceptual models of power as articulated by Morganthau, Ray, Kegley and Wittkopf, and Rosen and Jones. Was this assumption reasonable? With all these data and methods of thinking about the world, special textual materials for both the teacher and student seemed to be called for. We decided to add a text, on disk, that would summarize the most contemporary scholarship on the concept of power and directly relate to the computer exercises and concepts to which students were being introduced.

We also added a database file that contains test questions categorized by chapter, subject, and type of question; a 60-item glossary that explains the terms in the database; and a glossary-in-context that explains the specialized vocabulary found in the textual materials.

Additional bonuses of having textual materials on disk and using databases that can be modified are that both students *and* teachers can provide input into *The Power of Nation States*. Students are encouraged to challenge (with substantiating documentation) the data that the database provides. Teachers in other countries can change the directions for Lesson One so that students identify states that are friendly or hostile to their country.

There are dozens, if not hundreds, of lessons that can be devised from *The Power of Nation States*. Teachers should approach these materials with creativity and with a sense of adventure. You should not feel bound or limited by what we have produced. We encourage you to create your own textbooks, your own tests, and your own lessons.

The Power of Nation States puts power in the hands of the students. Manipulating the up-to-date, extensive statistical data on each of these countries is extremely enjoyable for them. Using the power of the computer to arrange, calculate, and compare data, students grasp concepts not readily attained using traditional approaches. They learn to pose their own questions and test their own hypotheses, and in so doing, they develop the conceptual understanding and critical thinking necessary for the information age.

[Alice Jagger, Tom Layton, and Bob Veeck, South Eugene High School, 400 E. 19th, Eugene, OR 97403.]

Computer Directions:

The original formula assumes that every $4 billion in GNP is worth 1,000 nuclear weapons in determining Power. It also assumes that every 200,000 people or every 10,000 people in the Armed Forces are worth either $4 billion in GNP or 1,000 nuclear weapons. We would like you to determine what you perceive to be the relative worth of each of these components of power (remembering that there is no correct answer). (Refer to the "Power Criteria" list you made for Computer Lesson 4.)

For example, if you feel that economic power as measured by GNP, PCI, TVI, and TVE are more important than military power as measured by TME, # Nukes and Armed Forces, award points in your formula accordingly. Let us take a moment and analyze the number of points to be awarded for nuclear weapons. Many would argue that nuclear weapons are the ultimate component in judging a state's power. Others would argue that nuclear weapons actually detract from a state's power. What do you think? The original power formula with which you began to work assumes that nuclear power is relatively unimportant. You could dramatically change the results on the power formula by awarding 100 points for every 1,000 nuclear weapons. You might also consider what would happen to the results if you awarded 10 points for every 200,000 human beings.

As you manipulate the formula, remember that you may also alter the aggregate quantity on the right hand side of the formula. For example, you might want to award 1 point for each nuclear weapon or one point for each human being on the planet. You control the results. Your perception of each component of power will determine which states will make the top 15 list and in what order they will appear.

When you have adjusted all of the point values, it is time to recalculate the spreadsheet based on your new formula. Press Open Apple K to have the spreadsheet calculate the most powerful nations according to your indication of the importance of each category. (This recalculation will take quite a while. BE PATIENT!) Repeat this process until you are happy with the results. After you have completed this part use OPEN APPLE H to dump the screen showing your power formula. Place the cursor on the first TOTAL score once again and press OPEN APPLE A to rearrange the states in order of power points. Use the DOWN ARROW key until you reach the bottom of the list and press RETURN. Arrange "From 9 to 0" and press RETURN. Use OPEN APPLE H to dump the screen showing your power formula and then dump the screen again showing the top 15 states according to your formula.

Method of Evaluation:

When students have completed the compilation of data and have a completed set of discussion notes, make the following assignment:

We have been looking at certain factors that we believe help to determine how much power a state may or may not have. Using your notes and/or any other computer data available:

1. Identify the eight states in the world that you believe possess the greatest amount of power. (Rank order them one through eight, with one being the most powerful.) Explain your choices.
2. Now that you have selected the 15 most powerful states, what are the key components in your definition of power? Explain each.
3. Are there other components of power on this disk that you would rather use to assess state power? Why?

NOTE: Have students retain formulas with their points and units.

Answer Key:

This is the fun part! Answers will vary greatly depending upon the weight students give each factor in their power formulas. We cannot predict what a reasonable formula or set of definitions of Power would look like; therefore we turn control of the lessons over to you, the teacher. You and your students will have to determine the correct answers to lesson #5.

Questions for Further Consideration:

1. What were the 15 most powerful states 100 years ago?
2. What will be the 15 most powerful states 100 years from now?
3. Will human beings evolve in the way they live so that power is no longer a consideration in the conduct of international relations?

The Computing Teacher June 1988

Enhancing Learning Through Debriefing

by Bob Gray

Jamie sat at her desk with a far-away look in her eye. She was thinking about the software simulation she had just finished. Jamie saved her tribe from starvation—even though her leg was wounded—and in her mind she was still stalking through the African jungles carrying a spear. She was eager to talk about it, dying to be asked a question. Would the teacher encourage her to express her excitement? Or would the class simply move on to the next activity?

In this scenario the student's interest and involvement is at an all-time high. She still feels like a native hunting for food in central Africa. If the teacher neglects to wrap up the new knowledge, allowing the student to discuss her successes and failures, the teachable moment may be lost.

Why Debrief?

The successful integration of computers into the curriculum involves many steps, even after choosing good software that meets curricular goals and objectives. Raths (1987) defines debriefing as the process that gives students relatively free rein to organize, evaluate, summarize, or analyze a learning experience. Debriefing and integrating learning activities with the goals and objectives of a unit is a step often omitted or only touched upon. But debriefing can be one of the most important steps in curriculum integration of computers, resulting in highly personal and often very meaningful learning outcomes.

When you provide ample opportunity for students to build bridges from old learning to new material, students can reflect on the nature of the concepts, analyze their impact, and relate to past learning in a manner that amplifies and clarifies both old and new knowledge. Some outcomes of debriefing are:

- Increased understanding of content;
- Improved problem solving strategies;
- Exposure of misunderstandings and personal theories;
- Increased ability to recall content; and
- Increased motivation.

The result of a comprehensive debriefing experience is the meaningful integration of subject matter and increased motivation for the next learning experience.

Debriefing Strategies

To follow up lessons that have taken advantage of the computer, talented teachers can select debriefing strategies from a large number of possibilities. Here are some tested techniques.

Role-playing is an effective way to capitalize upon the interest generated by a lesson and channel it into a more focused, reflective thinking mode. First of all, role-playing allows students to express the feelings they experienced while using the program. Sometimes students need help returning to reality after participating in a complex, engaging microcomputer simulation. Some continue to carry a spear around the class long after the program ends. Role-playing should allow learners to express their feelings in a positive, supportive environment. After expressing their feelings, students can more objectively reflect upon the decisions made in the simulation.

Role-playing also enhances decision making. In acting out the decisions made in the simulation with their classmates, students experience their own decisions again in a different environment from the computer, and they also see what decisions their classmates made. After the emotional release of the physical activity and looking at the situation from different perspectives, students can more objectively analyze their decision making processes—by themselves or in class discussion.

The revised edition of *Oregon Trail* (MECC) is a good example of a simulation that can be followed by an exciting role-playing activity. Students can imagine themselves in a covered wagon, battling the elements to reach Oregon. Choose a scene, for example, where students approach a stream and try to decide whether to ford it. Have students pretend they are part of a wagon train so that all groups can participate.

Each group will have a chance to hear prior experiences of the other groups based on how they played the computer simulation. Afterward, they will be better able to evaluate their own decisions and decision making processes.

Writing a reaction paper helps students summarize the content and analyze major concepts in a software program. This exercise requires students to relate their new knowledge to past learning.

Where in the World is Carmen Sandiego? (Broderbund) is an excellent simulation in which students learn facts about geography in a problem solving environment. As a rookie detective assigned to catch Carmen Sandiego and her band of thieves, a student travels through the program to different countries. Descriptors of the countries through which Carmen has passed serve as clues, thus guiding the student detective's search.

As part of the computer activity, have students trace the paths of Carmen and themselves on a map you've provided. Also have students list the major characteristics of each country visited. Then, as a debriefing activity, have students write a paper on what they have learned about world geography as a result of playing *Where in the World is Carmen Sandiego?* Emphasize that the paper is not a listing of the facts recorded on their maps. They should think about general statements they can now make. For example, "I now know that people in different countries speak different languages and use different types of money." Or, "I know something about distances in the world because I know how long it takes to fly from London to Cairo."

This type of reaction paper helps students synthesize geographical facts into concepts. Another type of reaction paper can be used for debriefing the problem solving strategies used in playing the game. During the computer activity, have students keep a log of the cities and places in the cities they visited and why. As a debriefing activity have students write down and critique the investigative methods they used as the detective. Students should gain some idea of the benefit of prior experience and knowledge in the problem solving process. (One note of caution: Don't have students record too much information before they see its value in playing the game or in debriefing. At first, let students discover their own approaches.)

Comparing and contrasting two concepts helps intensify a student's learning experience by building bridges between old and new knowledge. This can be a paper assignment or the focus of a discussion. In either case, develop some type of chart that lists similarities and differences.

Green Globs and Graphing Equations (Sunburst) consists of three activities and an equation plotting utility. The activities motivate students to determine graphs from equations and vice versa without tedious point plotting. By trial and error, students modify and refine equations to find the graph or graphs that will intercept the 13 green globs scattered randomly on a grid.

As a follow-up discussion, generate a table as students compare and contrast different types of equations and the graphs they produce. Attributes to look for in graphs include slope, intercept, critical points, and so forth. Attributes of equations include coefficients, exponents, trig functions, and so forth.

Logo is often used to introduce and explore geometric concepts such as polygons. After students have generated a number of four-sided, closed polygons with right angles, have them classify the figures as squares or rectangles.

Comparing and contrasting activities helps students fully explore a concept and helps them generalize from their computer activity. In the process student misunderstandings and incorrect models are often exposed and can be corrected.

Drawing a visual summary after a computer activity enhances newly attained concepts by providing a concrete, highly personalized experience. Make transparencies of student drawings and have students describe their development as part of a follow-up discussion.

Botanical Gardens (Sunburst) helps students learn the importance of controlling plant growth variables. After using the program, have students draw a series of pictures depicting the growth of plants under a specified variety of physical conditions, or showing various stages of growth, conditions needed for growth, or parts of a plant.

Protein Synthesis (Helix) describes the process of protein production from basic genetic controls. Making pictures that summarize this rather complex program would help students organize the new knowledge.

Conducting a panel discussion based upon a software program produces a lively exchange to dispel misconceptions and reinforce learning. *Balance of Power* (Mindscape) is a complex, sophisticated game. As a leader of one of the superpowers, the user's object is to survive from 1986 to 1994 without blowing up the world. A panel discussion concerning specific strategies the real superpowers use produces an exciting, motivating debriefing activity. Individual students or teams represent the superpowers and analyze specific actions (e.g., trade embargoes and military actions) in relation to international problems. Each leader will have six or seven advisors to assist in developing policies. Have one class member serve as secretary to compile the data and indicate findings on the chalkboard for all class members to see. At the end of this panel discussion, students will have greater insight regarding major world problems.

Evaluating the program by using standard software evaluation criteria can help improve students' understanding of the content and provide valuable input to the teacher on how much the students have learned. In the process of filling out a software evaluation form, students will be thinking about the objectives of the software (after finding them in the documentation), how well they have been met, and how much the software has contributed to their overall understanding of the subject matter. They are in the best position to evaluate how well certain features of the software such as color and sound use or feedback on incorrect answers aided in their learning. Make sure the form is not too much of a checklist or too laden with educational jargon. Adapt the form so that students tell what contribution the use of color made, not just whether it helped in understanding the content. This activity has an added plus: It helps students become more critical software consumers.

Odell Lake (MECC) is a simulation designed to teach young students about predator/prey relationships and the food chain. Teachers can have students evaluate the effectiveness of the two modes—simulation and game. What did they learn from each? Was one more effective than the other?

Simulating a particular computer environment or scene from a program may improve overall learning and increase motivation. Simulating a scene by acting it out is not as open ended as role-playing. But it can be just as fun and requires synthesizing knowledge of the event as well as attention to detail. Adding stage props and costumes or actually creating a physical model of some environment challenges students' creativity and ensures retention of what they're learning.

Interviews with History (Educational Publishing Concepts) is a program in which students act as reporters interviewing famous historical figures. An in-class simulation of an interview with a famous historical figure (a member of the class, a parent, or another teacher) provides for a more interesting experience. An interview with honest Abe Lincoln right in the classroom gives students a chance to ask their own questions, gives the teacher a chance to hear what students are interested in, and lets everyone have some fun.

The Teacher's Role

These debriefing activities are all different, but they all provide additional learning experiences, develop analysis skills, and allow for closure. To provide even more motivation, give students some freedom in the choice and development of these activities.

Plan the debriefing activities very carefully. Secure the needed resources, allow ample time, collaborate with students, and select the most appropriate strategy based upon the software used, the characteristics of the learners, and available resources.

Feedback from the teacher and other students is an important part of the debriefing and integration process. Look for ways to make the debriefing activity as interactive as possible. Follow debriefing activities that are individual in nature (for example, writing a reaction paper or creating a series of drawings) with discussions in which students share their strategies, conclusions, or results.

The debriefing phase can be *the most important* aspect of curriculum integration of computers. It represents an exciting opportunity for teachers and students to use their creativity. Well designed follow-up activities will motivate students, expand their learning horizons, and lead to more positive and substantive learning outcomes. Like the student at the beginning of this article, students on the whole often require the debriefing step. Help students learn when and where to leave the spear behind. Capitalize on their motivation. This is a major opportunity that teachers cannot afford to miss.

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Database Activities in a One-Computer Classroom

by Jim Watson

Students who leave school with just a set of static facts will be ill-prepared for a world in which they will change careers 6-10 times (Bailey, 1986). Students need to know how to *get* the facts and how to *use* them well. If students learn to use a database manager for storing and manipulating information, they will have taken a step toward preparing themselves for the information age, and they will have a tool to take with them.

A database is a valuable teaching/learning tool with the potential to help you present material in more depth, in a different and interesting way. While a database manager is not the tool for every analysis of information, it has several advantages: (a) It can contain an incredible amount of information, (b) it can organize data in almost any form, and (c) it is very fast at finding and organizing information.

With these advantages, a database provides an ideal environment for students to learn to organize, analyze, synthesize, and evaluate information. Students can gather, format, rearrange, and update information; show relationships; find trends; and test hypotheses. In short, a database allows students to go beyond the facts (Beverly Hunter, 1985). It allows the use of higher level thinking skills to explore the *meaning* of the facts. As the students begin using the database to make connections, see relationships, and draw conclusions, you are going to hear a lot of "Aha's" in the classroom. Databases are an exciting way to learn.

Obviously databases are hands-on computer programs. Students need access to appropriate equipment, but a lot can be achieved without a whole labful of computers. Can the advantages described above be realized in the one-computer classroom? From my experience the answer is "Yes." I have found several advantages and methods for managing classroom computer use. A variety of activities can be used with either a whole class or learning center approach.

Advantages to Working in the Classroom

First, less instructional time is required when one computer is being used by the whole class. It is not necessary for every student to know every command of the particular database program being used. The teacher is better able to instruct as problems occur. There will be less chance of losing data, less scrambling from computer to computer to solve problems. The reduced knowledge base required to use one computer in a class is a particular advantage with younger students (Grades 3-6).

Second, the first time a teacher uses a database with a class, the unit may be a little on the rough side. In a classroom, omissions and errors in instruction are discovered by the first class you teach or the first group on the computer and they can be corrected for the rest. In a lab, the difficulty of correcting these errors is multiplied by the number of students assigned to computers. Picture the mayhem as one by one the groups in the lab discover that an important step has been left off a worksheet.

Third, using one computer for the whole class can foster a spirit of teamwork and cooperation. Pressure on less able students is reduced when they do not have to produce results from a database totally on their own. In a lab, students frequently race against those at adjacent computers, resulting in sloppy work. Such competition doesn't occur in a one-computer classroom.

Finally, having the computer in the classroom instead of the lab gives a direct connection between the regular curriculum and the data file used on the computer. A trip from the classroom to the lab often makes this connection difficult to maintain. (To some students the lab seems more like an arcade than a classroom.) And while the lab schedule does not often tie in neatly with the flow of the curriculum, the classroom computer is always ready for the teachable moment.

Clearly there is room for databases in both the lab and the classroom. But it is liberating to know that a school does not need a lot of hardware to make a database unit possible.

Once students become comfortable using databases, they will be able to use them on (or even create them for) independent projects. I see students becoming comfortable with databases in the supportive group learning environment of the classroom and then moving to the lab to use their new tool independently.

Databases can be used to research material from almost any subject area. Social studies (states, countries, elections); science (elements, animals, dinosaurs); health (foods, drugs); reading (favorite books, vocabulary, authors); language arts (parts of speech, spelling words); multicultural studies (notable people from various ethnic groups); art (artists, periods) are all possibilities. Once students are able to use a database they can use it to broaden their knowledge in nearly any area.

Managing Computer Time

In a single-computer classroom, databases can be demonstrated and used by combining whole class activities and small group, learning center activities.

Whole class activities are appropriate for introducing and demonstrating database use no matter how many computers are available for individual or group work. A large screen monitor or (preferably) a data projection panel is necessary for whole class demonstrations. Some whole class activities discussed below are useful for practicing content and higher order thinking.

A learning center approach allows students to have small group time using databases The computer and a printer form a single or one of several learning centers in a classroom. Student groups of two or more rotate to the computer while other students are working at their desks or at other centers. This approach requires extra planning as the teacher must think about two or more activities going on at one time. All of the usual advice for this approach applies, such as designating and training some student experts and/or outside volunteers.

Suggested Activities

One method of introducing databases to students is by demonstrating some of their advantages. Possibilities include:

- Speed—Compare the time it takes people to alphabetize or numerically order data to the computer's time for arranging data;
- Quantity—Show students how much information a data file can hold by browsing through a large file such as

MECC Dataquest: The Fifty States or *The Power of Nation States;*

- Versatility—Show several different types of files such as a mailing list, a geography file, or a budget; and
- Flexibility—Sort and display a file in a variety of ways, for example, alphabetically and numerically by different fields.

A number of methods can help you introduce a particular database to students.

Browse and Question involves slowly browsing through each record as students look for interesting facts, oddities, and relationships. Stop when a student sees an item of interest or when someone wants to ask a question. One student in a recent class stopped me to ask why Virginia was in the South region while West Virginia was in the Mid-Atlantic. This led to an important, motivating discussion that began with "Who assigns states to regions, anyway? And why?" and ended with a brief exploration of how the Civil War split some states and even families.

A **Scavenger Hunt** can be done with the whole class, as a learning center activity for small groups, or in the lab. Make a worksheet of questions that have answers in the data file (see Figure 1). Have students or student partners take turns telling the computer operator (teacher or student) which records to put on the screen, how to arrange the data, and so forth. Everyone records answers on their own worksheets as they discover them on the screen.

Games are an effective way to practice knowledge of database content and manipulation. To play the **Fact Game,** divide the class into two teams. Have each team make up 10 questions with factual answers they believe are in the data files. Write the questions on 3 X 5 cards. Members of Team 1 draw one of their cards and read it. Team 2 uses the database to try to answer the question. Team 1 checks the answer. If the answer checks out, Team 2 gets a point. If it is wrong, no points. If the answer is not in the file, subtract 1 from Team 1's score. Continue until all questions are answered.

The **Attribute Chain Game** also requires dividing the class into two teams. Team I calls out the name of a record in the data file. Team 2 names another record that they think has an attribute in common with Team 1's. Students check the answer on the computer. Team 1 names a record with an attribute in common with Team 2's. Check. Records already named are out of play. The team that stumps the other team wins. In a States file, for example, if the first team calls out California, Team 2 might name Oregon because the two states are in the same region. Next Team 1 might name Maine, whose largest city, Portland, matches that of Oregon. For a variation, students or individuals can try to make chains that include all the records.

The next two activities use databases to develop higher order thinking.

Use **preprinted reports** to analyze data. Before class, prepare and print out a database report including data that illustrate an important point from the curriculum. Develop questions that require students to compare and contrast fields, find relationships, and test hypotheses. Duplicate a copy for each student or team and have them analyze it in class discussion, on a worksheet, or in a paragraph or two. Examples might include a list of animals with their body weights and lifespans, or perhaps a report on countries showing average income, population density, and infant mortality.

Using the data file to answer questions and test hypotheses becomes both a whole class and a learning center activity. First have the class brainstorm a list of questions to be answered and/or hypotheses to be tested with the data file. One way to help students generate ideas is to browse through the data file while focusing on one category and its relationship to other categories. You might arrange *The Power of Nation States'* Literacy field from high to low, for example, and as you browse have students watch Gross National Product and Political System looking for patterns. Use a planning sheet (see Figure 2) or a similar worksheet as an overhead transparency to plan the report to be printed. Then have students use the computer one at a time to generate their reports.

Build a Class Data File. When a class is doing research on a subject area, each student can enter some of the data he or she collects into a collective data file. Students see the importance of their research when it becomes an integral part of the whole classes' study. Too often, student research is forgotten once the grade is on the paper. But having the information in a data file allows students to use higher order thinking skills to analyze it. Be sure to plan the file before students start their research to assure that students collect all the information they will need.

The Teacher's Role

As with word processors, there are no bells and whistles in database programs. Self-motivation comes after students discover what can be done. In the beginning the teacher will need to provide motivation in the form of strokes and reassurance that the skills being learned are of value. Lists of numbers can be pretty numbing to look at for novice databasers. One way around this is to assign data to categories such as "high," "medium," and "low," and to enter those words rather than the numbers into the data file. Instead of listing per capita income, for example, you could designate states with average personal incomes over $17,000 as high, $14,000-17,000 as medium, and below $14,000 as low. A cluster of high income states might be easier for students to analyze than a series of numbers.

A database is just a collection of data. No matter how usefully sorted and selected the information is, it needs *humans* to analyze and evaluate it. It is tempting to accept the information as the cold, hard facts and forget two things:

- Facts are rarely objective; and
- There very real people behind the facts.

Unemployment figures, for example, represent thousands of people who desperately need jobs. It is up to the teacher to help the students put the facts in perspective.

The key to perspective is **debriefing.** Each analysis, each conclusion drawn from data, must be accompanied by conferences or whole group discussions that help students gain perspective on the results. Some questions a teacher might ask during debriefing conferences include:

- What is the answer to your question?
- Does the report seem to support your hypothesis?
- Can you point out some data in your report that seem to support the hypothesis?
- Can you point out some data that seem to refute the hypothesis?
- Could you make a new hypothesis based on the data?
- What is your opinion about this topic now that you've examined it?
- Who might be interested in the results of your report? Could the results help anyone?
- What was your strategy for using the database to answer your question?
- Are any of the data suspect? How do you think they were gathered? Where could mistakes have been made?

- Can you learn anything from data that show no relationship between certain categories?
- Do your results raise more questions? How could they be answered? Are any of these questions important and interesting enough to examine for a project?

Conclusion

Databases may not be one of the types of programs you think of when planning to use one computer in a classroom. But it is possible to use them there, and are they ever worthwhile! Of course, getting students to analyze and evaluate information is wonderful, but maybe the real measure of the success of using databases with students is the *"Aha's"* per class period.' And the *"Aha's"* are definitely up!

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Software

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The Power of Nation States. AppleWorks data files *(MSWorks* in press); $59.95 with classroom license, $95 with site license. ISTE, 1787 Agate St., Eugene, OR 97403-9905; ph. 503/686-4414.

Name(s) ______________________

Scavenger Hunt

EXPLORATION WORKSHEET

Use the States data file to answer the following questions.

1. How many states begin with the letter "M"?
____
2. What state's population grew the fastest? (Name the state.)
____
3. Name the state that had a falling population.
____
4. What is the *area* of the largest state of the U.S.?
____
What is this state's *population?*
____
5. *How many* states are larger in area than Oregon?
____
6. Name two states that are larger in area than Oregon.
____
7. What is the capital of North Dakota?
____
8. What *city* has the largest population in the U.S.?
____
9. What *state* has the smallest "largest city"?
____
10. What state's largest city gets the most rain?
____
11. What state's largest city gets the least rain?
____
12. What state was admitted to the U.S. the same year as Florida?
____
13. Write your own question and answer.
____

Figure 1.
From Teaching Thinking Skills with databases.

Name(s) ______________________

Planning and Using a Report

1. Write your question, problem or hypothesis.
____
2. Do you want every record in the file in your report? (If YES, skip to number 3.)
____
   a. Which category do you want to limit?
   ____
   b. Which limiter? Circle one:
   is greater than
   contains
   does not end with
   does not contain
   does not begin with
   is not equal to
   is not blank
   begins with
   is blank
   is less than
   equals
   ends with
   c. What is the information you want to match?
   ____
   d. Do you want a "second tier" selection? If so, will it be an AND or an OR selection? List the second category, limiter, and limiting word or number below.
   ____
   e. Do you want a "second tier" selection? If so, will it be an AND or an OR selection? List the second category, limiter and limiting word or number below.
   ____
3. List the categories you want to include in the report. Put them in order. Beside each category, write how many spaces it will have on the report.
____
4. Which category do you want your list sorted by?
____
5. What kind of order: A to Z, Z to A, O to 9, 9 to 0?
____
6. Will you print the report to the PRINTER or SCREEN?
____
7. Use this plan to print your report at a computer station.
____

—AFTER PRINTING—

What did you learn from the report? What is the answer to your question or problem? Does your report support your hypothesis? Explain.

Figure 2.
Preprinted Report. From Teaching Thinking Skills with Databases.

A Mineral Database Program

by Jacob M. Hirschfelt

While I recently worked with students on a mineral laboratory exercise, it became clear to me that some students just could not get the hang of using the mineral identification key. No matter how many examples I used, they still had trouble grasping what I call the "questioning technique." In a sense, this is a method of the experienced scientist; in mineral identification a scientist would determine a specimen's hardness, streak, luster, etc., and then compare these observed characteristics with his or her mental database. If a match was found, the mineral would be identified.

After reaching the conclusion that the mineral laboratory exercise was a waste of time for some students as presently set up, I thought, Why not teach them the method of the scientist? I decided the best method available would be a computer program to aid in developing an understanding of the process that a scientist goes through to arrive at a conclusion. Since I was not aware of such a program's existence, I decided to write one in BASIC. While the program listed below works with minerals, it can be modified as a bird key, tree key, or any key that is moderately simple.

As listed, the program can accommodate over 100 mineral entries (the variable SIZE must be altered when you increase or decrease the number of entries). Some minerals have been entered more than once; quartz, for example, because of its great color variation. Also, I have included parenthetical information with most minerals in the database to aid in confirming identification. For example, "calcite (bubbles in acid)" tells the student that this characteristic is important when identifying this mineral.

As the program runs, it prompts students to choose options for the mineral's color, the color of its streak, the presence or absence of cleavage, relative hardness, and luster. If a match is found to the students' responses, students are informed of their mineral's possible identity. If no match is found, students are informed that the mineral may not be in the database. Students may then elect to continue or quit.

The routine STREAK, typical of the five routines, works as follows. First, the string variable NAME$ is set to the null character. Then the program asks for the mineral's streak. Using the ON VAL (ANS$) GOTO statement, the program allows only the character 1, 2, 3, or 4 to be entered. The character is retrieved with a GET statement (therefore a RETURN is not needed with each entry). The character retrieved is added to the string NAME$, which will hold five characters, each representing one of the five tests performed.

In the routine CHECK DATABASE (after each of the five questions have been answered), the program resets the data (RESTORE) and reads it. The program then compares each string integer value at the end of each data line with the current value of NAME$. If a match is found, the name of the mineral is placed in the string FOUND$ and a flag is set. Next, the program prints out the possible mineral. If no match is found, the user is informed. In either case, the program prompts the user to continue or quit.

Since the database uses characters to represent the characteristics tested, you can have up to 10 different characteristics (numbered 0-9); for example, 10 different colors.

I have found that students become better observers and better identification key users after they work with this data base. The computer also makes the lesson much more exciting.

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```
1      REM MINERAL IDENTIFICA-
       TION SYSTEM
2      REMJ.M. HIRSCHFELT
3      SIZE=29: REM SIZE OF DATA
       BASE
4      DATA CALCITE (BUBBLES IN
       ACID) ORHALITE (DISSOLVES
       IN WATER), 35112
5      DATA PYRITE (GOLD COLOR
       BUT BLACK STREAK), 13231
6      DATA GRAPHITE (WRITES ON
       PAPER), 11213
7      DATA GALENA (SMELLS OF
       SULFUR IN A C I D ), 11111
8      DATA QUARTZ (COLOR VAR
       IES), 36232
9      DATA QUARTZ (COLOR VAR
       IES), 45232
10     DATA QUARTZ (COLOR VAR
       IES), 35232
11     DATA QUARTZ (COLOR VAR
       IES), 46232
12     DATA MAGNETITE (MAGNE-
       TIC), 11231
13     DATA MICA (BIOTITE), 31112
14     DATA GRAPHITE (WRITES ON
       PAPER), 11211
15     DATA GRAPHITE (WRITES ON
       PAPER), 11213
16     DATA FELDSPAR (ORTHO-
       CLASE),32132
17     DATA GARNET (BRITTLE; RED)
       OR QUARTZ (COLOR VARIES),
       42232
18     DATA TALC (FEELS SOAPY),
       35113
19     DATA TALC (FEELS SOAPY),
       35213
20     DATA HEMATITE, 22221
21     DATA HEMATITE, 21221
22     DATA GYPSUM (BREAKS INTO
       FINE FLAKES) OR MUSCOVITE-
       MICA (PEELS INTO SHEETS) OR
       CALCITE (BUBBLES IN ACID),
       36112
23     DATA SPHALERITE (STREAK
       MAY SMELL OF SULFUR), 35222
24     DATA SPHALERITE (STREAK
       MAY SMELL OF SULFUR), 31222
25     DATA FLUORITE (CLEAVAGE/
       CUBES OR OCTAHEDRONS),
       36122
26     DATA FLUORITE (CLEAVAGE/
       CUBES OR OCTAHEDRONS),
       35122
27     DATA FLUORITE (CLEAVAGE/
       CUBES OR OCTAHEDRONS),
       33122
28     DATA FLUORITE (CLEAVAGE/
       CUBES OR OCTAHEDRONS),
       34122
29     DATA CORUNDUM (VERY
       HARD/ 9), 42232
30     DATA QUARTZ (COLOR VAR
       IES), 31232
31     DATA QUARTZ (COLOR VAR
       IES), 41232
32     DATA QUARTZ (COLOR VAR
       IES), 32232
107    REM END DATA
108    REM ********************
```

```
109   REM TITLE
110   HOME : VTAB10: HTAB15
120   PRINT “MINERAL”
130   VTAB11: HTAB 8
140   PRINT “I D E N T I F I C A T I O N”
150   VTAB12: HTAB 9
160   PRINT “S Y S T E M”
170   INVERSE : VTAB 21: HTAB15
180   PRINT “PRESS ANY KEY”;
190   NORMAL:GET ANS$: HOME
199   REM *********************
200   REM INTRODUCTION
202   PRINT “THIS PROGRAM WILL
      HELP YOU”
205   PRINT “IDENTIFY UNKNOWN
      MINERALS YOU”
210   PRINT “HAVE TESTED FOR:
      STREAK, COLOR,”
215   PRINT “CLEAVAGE, HARDNESS,
      AND LUSTER.”
250   INVERSE :VTAB 21: HTAB 10
260   PRINT “PRESS ANY KEY”;
270   NORMAL: GET ANS$: HOME
280   HTAB 10
290   INVERSE: PRINT “MINERAL
      IDENTIFICATION SYSTEM”:
      NORMAL
295   FOR I=1 TO 39: PRINT “*”;: NEXT

300   POKE 34,2: REM REDUCE
      SCREEN
398   REM *********************
399   REM STREAK ROUTINE
400   HOME: VTAB 10:NAMES$=" "
410   PRINT “WHAT IS THE COLOR”
      420 PRINT “OF YOUR MINERAL' S
      STREAK?”: PRINT
430   PRINT “1=BLACK/GRAY”
435   PRINT “2=RED/PINK/BROWN”
      440          PRINT “3=WHITE/
      YELLOW”
450   PRINT “4=COLORLESS OR
      CLEAR”:
      PRINT
460   PRINT “PRESS 1 OR 2 OR 3 OR 4:”;

470   GET ANS$
475   ON VAL (ANS$) GOTO
      500,500,500,500
490   PRINT CHR$ (7): GOT 400
500   NAMES$=NAMES$+ANS$
510   REM *********************
520   REM COLOR ROUTINE
600   HOME: VTAB 10
610   PRINT “WHAT IS THE COLOR”
620   PRINT “OF YOUR MINERAL?”:
      PRINT
630   PRINT “1=BLACK/GRAY”
640   PRINT “2=RED/PINK/BROWN”
650   PRINT “3=GREEN/GOLD”
660   PRINT “4=BLUE”
670   PRINT “5=WHITE”
680   PRINT “6=COLORLESS OR
      CLEAR”:
      PRINT
685   PRINT “PRESS 1 OR 2 OR 3 OR 4
      OR 5 OR
      6:”;
690   GET ANS$
700   ON VAL (ANS$) GOTO
      720,720,720,
      720, 720, 720
710   PRINT CHR$ (7): GOTO 600
720   NAMES$=NAMES$+ANS$
798   REM *********************
799   REM CLEAVAGE ROUTINE
800   HOME: VTAB 10
810   PRINT “DOES YOUR MINERAL
      HAVE
      CLEAVAGE?”: PRINT
820   PRINT “1=YES”
830   PRINT “2=NO”: PRINT
840   PRINT “PRESS 1 OR 2:”;
850   GET ANS$
860   ON VAL (ANS$) GOTO 880,880
870   PRINT CHR$ (7): GOTO 800
880   NAMES$=NAMES$+ANS$
898   REM *********************
899   REM HARDNESS ROUTINE
900   HOME: VTAB 10
910   PRINT “WHAT IS THE HARDNESS
      OF”
920   PRINT “YOUR MINERAL?”: PRINT
930   PRINT “1=3 OR LESS”
940   PRINT “2=HARDER THAN 3 BUT
      LESS
      THAN 6”
950   PRINT “3=6 OR MORE”: PRINT
960   PRINT “PRESS 1 OR 2 OR 3:”;
965   GET ANS$
970   ON VAL (ANS$) GOTO 990,990,990
980   PRINT CHR$ (7): GOTO 900
990   NAMES$=NAMES$+ANS$
998   REM *********************
999   REM LUSTER ROUTINE
1000  HOME: VTAB 10
1010  PRINT “WHAT IS THE LUSTER
      OF”
1020  PRINT “YOUR MINERAL?”: PRINT
1030  PRINT “1=METALLIC”
1040  PRINT “2=NON-METALLIC
      (GLASSY)”
1050  PRINT “3=NON-METALLIC (ALL
      OTHERS)”: PRINT
1060  PRINT “PRESS 1 OR 2 OR 3:”;
1070  GET ANS$
1080  ON VAL (ANS$) GOTO
      1090,1090,1090
1085  PRINT CHR$ (7): GOTO 1000
1090  NAMES$=NAMES$+ANS$
1098  REM *********************
1099  REM CHECK DATA BASE
1100  RESTORE
1105  FLAG=0
1110  FOR Y=1 TO SIZE
1120  READ A1$,A2$
1130  IF A2$=NAMES$ THEN FLAG=1
1135  IF A2$=NAMES$ THEN
      FOUND$=A1$
1140  NEXT
1145  IF FLAG=1 THEN GOTO 1200
1150  HOME :VTAB 10
1170  PRINT “SORRY YOUR MINERAL
      IS NOT”
1180  PRINT “IN THE DATA BASE”
1190  GOTO 1230
1200  HOME: VTAB 10
1210  PRINT “YOUR MINERAL MAY
      BE:”
1220  PRINT FOUND$
1230  VTAB 20: HTAB 15: INVERSE
1240  PRINT “PRESS ANY KEY”;
1250  NORMAL: GET ANS$
1300  REM *********************
1301  REM QUIT ROUTINE
1310  HOME: VTAB 10
1320  PRINT “DO YOU WISH TO
      CHECK”
1330  PRINT “ANOTHER MINERAL?”:
      PRINT
1340  PRINT “1=YES”
1350  PRINT “2=NO”: PRINT
1360  PRINT “PRESS 1 OR 2:”;
1370  GET ANS$
1380  ON VAL (ANS$) GOTO 400,1410
1390  PRINT CHR$ (7): GOTO 1310
1410  POKE 34,0: REM RETURN TO
      FULL
      SCREEN
1420  HOME: END
```

A Focus on History

by Rick Thomas

For social studies students and teachers alike, database files provide a new dimension in the study of history. Just as the invention of the microscope led to the discovery and understanding of a previously unknown dimension of physical activity and to a fundamental reinterpretation of existing knowledge in the life sciences, the use of computers to access and analyze data gives us the power to explore historical sources at a level of "resolution" previously not possible. Traditional sources such as public documents, private papers, diaries, letters, etc. have limited our understanding of the past by virtue of poor resolution, focusing attention largely on the political events for which the best sources exist and on the individuals most closely involved. We know very little about the majority of persons who lived in the past. One means of bringing their lives more clearly into focus is to make use of indirect information such as that found in tax rolls, census reports, and church and private business records. Because of the extent of these sources and the practical difficulties of working with them, they have been used only by professional historians who have had both the time and the facilities to deal with them. The existence of the classroom computer and easy-to-use data management software changes this situation, though. Sources such as the census report suggested in the following discussion can be made readily available to students and used as both learning and teaching resources, just as collections of traditional documents have been and continue to be used. The structured use of a computer software tool such as a database to search through and organize large amounts of information and to efficiently select data of importance to particular questions not only will improve students' information processing skills, but will allow students to focus on the task of interpreting and understanding content. The following example, drawn from an important chapter in early American history, is a case in point. The exercises are from the "Cherokee Frontier" activity in my book *ClassWorks: Microsoft Works for the Classroom*, and are intended for students in grades 8-12.

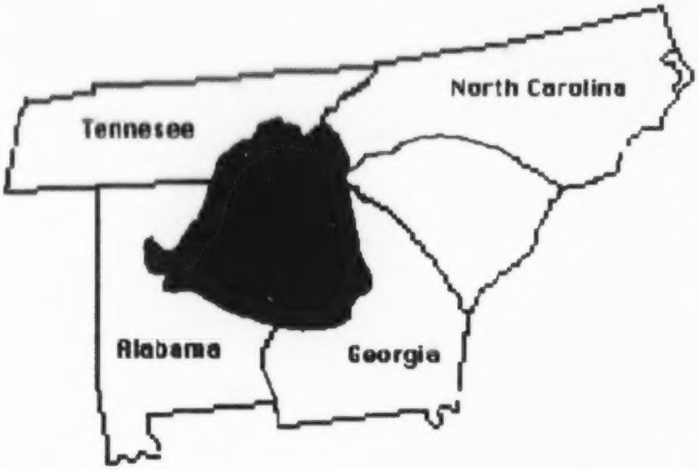

Figure 1. Cherokee Territory.

The Cherokee Frontier

In the early 1800s the basic policy of the United States government in regard to its relations with Native Americans was to remove the Indian population from areas, or potential areas, of white settlement. The most thoroughly documented instance of this policy and its consequences is the removal of the Cherokee Indians from their homelands in the southeastern states of Tennessee, Alabama, North Carolina and Georgia (Figure 1).

President Thomas Jefferson suggested in 1803, shortly after the purchase of the Louisiana Territory, that treaty arrangements be reached with the Cherokee and the other tribes of the southeast that would provide for removal of the Indians to new lands west of the Mississippi. Two such treaties were eventually negotiated and approximately one-third of the Cherokee population made the migration west by 1820. However, during the administrations of James Monroe and John Quincy Adams, the federal government adopted a more sympathetic policy towards the native tribes of the southeast, encouraging missionary efforts to "civilize" them, and recognizing more extensive rights of Indians over tribal lands. Missionary efforts among the Cherokee were particularly significant. Ten separate Methodist missions were established. Tribal schools were started, as was a tribal newspaper written in both English and Cherokee. Cherokee children were brought north to be educated in Methodist schools. And there were several marriages between Cherokee men and the daughters of church leaders. The ties thus established proved a powerful, albeit inadequate, source of political and moral leverage when the national debate over Indian removal reached a climax in the early 1830s.

Substantial conflict with the state government of Georgia developed as the federal government took the Cherokee side against encroachment by white settlers on Indian land. With the election of Andrew Jackson as President in 1828, the expansionists gained a sympathetic and powerful ear in Washington. Jacksonian Democrats prevailed by a single vote in Congress in 1830 with the passage of the Indian Removal Act, and again when President Jackson ignored the Supreme Court decision written by Chief Justice Marshall in the case of *Worchester vs. the State of Georgia*, which declared void Georgia's legal rights over the Cherokee. In 1835 the Treaty of New Echota was signed by a small party of Cherokee leaders forcing the tribe to cede their lands and remove to the

CHEROKEE CATEGORIES

Data File Categories	*Original Census Categories*
Residence	Residence
Males <= 18	Males under 18 years
Males > 18	Males over 18 years
F <= 16	Females under 16 years
F > 16	Females over 16 years
Total	Total Cherokee
M Slaves	Male slaves
F Slaves	Female slaves
Slaves	Total slaves
Whites by marriage	Whites connected by marriage
Farms	Farms
Acres in cult	Acres in cultivation
Houses	Houses
Wheat	Bushels wheat raised
Corn	Bushels corn raised
Wheat sold	Bushels wheat sold
Corn sold	Bushels corn sold
Total value	For how much
Corn bought	Bushels corn bought
Value	For how much
Mills	Mills
Ferry Boats	Ferry boats
Farmers > 18	Farmers over 18 years
Mechanics > 18	Mechanics over 18 years
English readers	Readers in English
Cherokee readers	Readers in Cherokee
Weavers	Weavers
Spinsters	Spinsters
Total Cherokee	Total

Figure 2: Categories in the Cherokee Database.

West. Though there were several delays, the removal of the Cherokee from Georgia, Tennessee, North Carolina, and Alabama along what has come to be known as the "Trail of Tears" was completed by 1839.

One of the major arguments against removing the Cherokee from their homelands was that by 1835 they had adopted many of the trappings of white, frontier civilization. They farmed, lived in houses, published a newspaper in their own language, and even owned slaves. A census was ordered as part of the Treaty of New Echota as a means of establishing the value of the Cherokee land so that reparations could be made. The information in this census can be used by students to gain a better sense of the everyday life of the Cherokee than that provided in most primary descriptions. It also provides a more detailed context for examining the ideas and attitudes of the white participants in the debate over Indian removal.

The database file involved represents a random sample of approximately 10% of the 1835 Cherokee census. It includes the categories listed and defined in Figure 2.

The readings in Fuller and Guttman and the other sources cited below provide a variety of additional background material. The following quotations from these readings suggest both the diversity of opinion regarding Cherokee life in the 1830s and the bias inherent in any primary description of an historical event:

"...the Cherokees are idle, uncultivated, and destitute of most of the comforts of life." *Rev. Ezra Styles Ely, Presbyterian minister, in a 1830 editorial in the newspaper* The Philadelphian. (Kilpatrick.)

"Sir, the mass of the Cherokee people have built them houses and cultivated lands with their own hands." *Rev. Samuel Worchester, Methodist missionary who lived among the Cherokee, in response to Rev. Ely's editorial.* (Kilpatrick.)

President Andrew Jackson used the following characterizations of the Cherokee and the other tribes of the southeastern United States in an 1830 speech (Fuller & Guttman):

- possessed of "savage habits"
- the wilderness is filled with a few "savage hunters"
- the Indian is a "wandering savage"

"The present condition of both Creeks and Cherokees who still remain in the states is most deplorable. Starvation and destruction await them if they remain much longer in their present abodes." *William Lumpkin, governor of Georgia, in a letter to President Andrew Jackson, 1835.* (Lumpkin.)

"They [the Cherokees] took to agriculture, and, without entirely foresaking their old habits or manners, sacrificed only as much as was necessary to their existence." *Alexis deTocqueville, French traveler in America in the 1830s who wrote about American institutions and people.* (Fuller & Guttman.)

Taken by themselves, these comments provide a fuzzy and fractured picture of the reality of Cherokee life. Certainly they need to be examined within the context of the political and social perspectives of their authors. While the organization and the content of the 1835 census reflect on the bias of its authors in perhaps a more subtle way, the level of detail in the report provides a more highly focused filter through which an understanding of the lives of the Cherokee can be gleaned.

Student Activities

The general discussion of the Cherokee removal and the comments from first and second person participants in the event raise a number of questions, including the following:

- What type of people were the Cherokee?
- Which of the descriptions of Cherokee life were most accurate?
- How will our understanding of Cherokee life affect our judgement of the events surrounding tribal removal?

In using the census to address questions such as these, students need to first explore the organization and contents of the file, which except for the abbreviations used and the elimination of notes the census takers

Head of Household: Rising Fawn
Residence: Chatouga, Alabama

M <= 18 2
M > 18 2
F <= 16 1
F > 16 3
Total 8

M Slaves
F Slaves
Slaves

Whites by Marriage
Value

Farms 1
Acres in Cult 3
Houses 3

Wheat
Corn 300
Wheat Sold
Corn Sold
Total Value

Corn Bought
Spinsters 2

Mills
Ferry Boats

Farmers > 18 2
Mechanics > 18

English Readers
Cherokee Readers

Total Cherokee

Weavers 1

Figure 3. Sample Record From the Cherokee Database.

Head of Household	Cherokee Readers	English Readers
Jos. Crutchfield	2	3
Corn Silk	2	2
Jno L. Yarnell		2
Levi Jones		2
Charles Harris		2
Thos. Cairy		1
Arch Salloee	2	
Thompson	2	
Nagin Snip	1	
Jiremiah Towers		5
David Taylor		4
Tahloteskey	2	
Walking Man	1	
Jenny Harnag	1	
Go a bout	3	
Wahhahche	1	
Cricket Six Killer	3	
Polly Crutchfield	3	
Culchalsky	1	
Ben Timberlake	1	
Chuwyostee	1	
Feather	3	
Ark a luka		1
Tetaweesky	1	
Floating Dog	1	
Bear	3	
John Nicholson		2
Sally		1
Chauchecca	1	
Robert Benge	1	1

Figure 6. Cherokee and English readers.

attached to some of the entries, are faithful to the original. Figure 3 is a copy of one record from the file.

Motivate student exploration by suggesting they examine individual names. Figure 4 includes a short sample.

Cornsilk
Levi Jones
Walking Man
Feather
Floating Dog
Bear
Robert Benge
Grease Gourd
Beaver Toater
Blanket

Figure 4: Cherokee names

Alexander suggests asking students how the names in the census reflect personalities and interests, and what, in turn, do the names suggest about the Cherokee culture? Most notable, perhaps, is the almost complete absense of names denoting violence or extreme action.

The data in the file allows students to evaluate generalizations about Cherokee life such as those quoted above. How accurate, for example, was Rev. Ely in stating that "...the Cherokees are idle, uncultivated, and destitute of most of the comforts of life"? Selecting households in which at least one farmer or mechanic was present (Figure 5) suggests that about 40% of the households are included.

Selection Rules

Farmers > 18 is greater than 0
-or-
Mechanics > 18 is greater than 0

Figure 5.

Likewise, it appears that about 30% of the households include at least one reader (Figure 6).

In this regard it is significant that the list of households meeting this criteria includes both cases in which the head of the household has a non-Indian name and approximately an equal number of cases in which the head of the household goes by an Indian name. Literacy was coming to Cherokee life.

Finally, the census file allows students to formulate their own conclusions about Cherokee lifestyle. Synthesizing the results of the previous activities and supporting arguments with conclusions drawn from the file and other available sources is an appropriate last step. The following assignment is one possibility:

> *The Office of Indian Affairs has assigned you the task of summarizing the lifestyle of the Cherokee based on the 1835 census. Write a short summary supporting your arguments with information and conclusions drawn from your examination of the census file and with notes from your reading, classroom lecture, and discussion.*

Conclusion

We are a long way from being able to see Cherokee life as it was. History never has and never will provide such a crystal ball to past events. At best, we see the past by studying indirect sources through lenses ground to contemporary standards. An electronic database is one tool students can use to adjust the focus a bit closer.

[Rick Thomas, 1974 Minda Drive, Eugene, OR 97401.]

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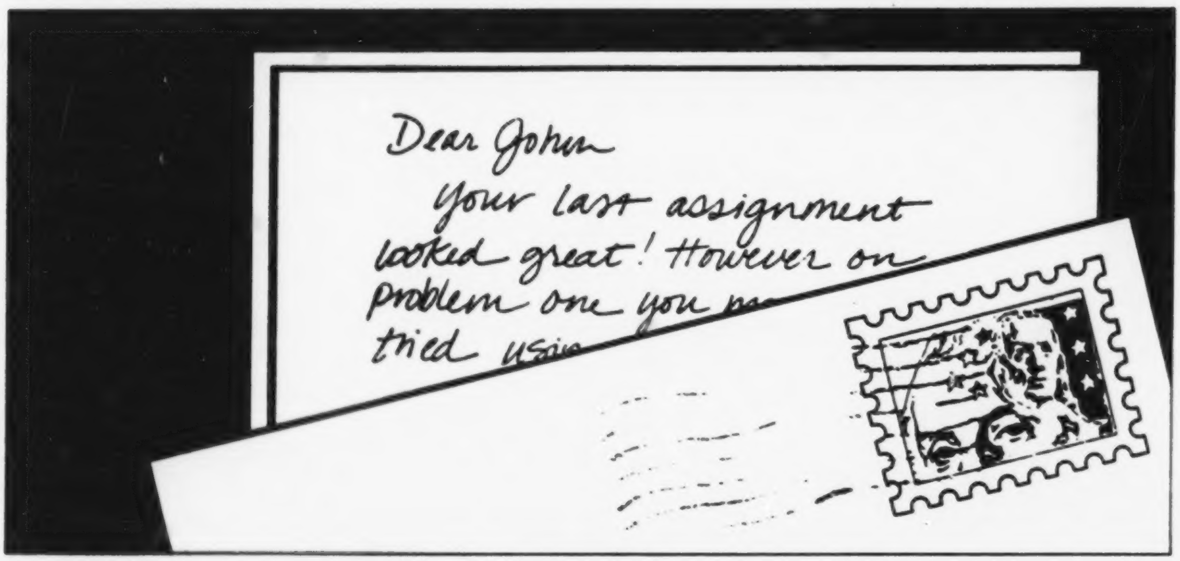
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